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Korotkova, P. I.
Sources and Means of Spreading Black Leg of Potato
Dok. 14(3):39-43. 1949. 20 Akl

Translated from the Russian
by S. N. Monson

Black leg of potatoes is a bacterial disease of which the inducer is Erwinia phytophthora (App) Bergey. The bacteria destroy potato tubers, then penetrate into the stems, causing infection of the root neck and finally the death of plants.

The distribution of black leg is fairly wide. Oblasts of moderate and humid climates, especially those having heavy clayey soils, are most favorable for the development of black leg.

Many researchers have engaged in the study of the sources of infection and the manner of its distribution, and have established that the inducer of black leg is resistant to low temperatures and able to winter in the soil. Iachevski (1) indicates that bacteria is capable of wintering in potato tubers that remain in the soil after harvesting. Naumov (2) considers bacteria causing black leg as typical soil organisms. He therefore recommends forestalling the appearance of the disease by alternating crops in such manner as to return potatoes to the same field no earlier than every 4 - 5 years.

In the years 1933-34 we engaged at the Leningrad Zonal Potato Station in work on ascertaining the significance of soil and seed material for the distribution of the black leg disease.

Two plots were set apart for experiments: one had formerly been waste land, where potatoes had never grown before, the other had previously yielded a potato crop. Diseased foliage was plowed into the second plot in the fall.

Both plots were planted with tubers of the EPICURE variety taken from both healthy and diseased plants. The latter were planted in whole and in cut tubers, the cutting of the tubers being done on the day of planting so as to prevent the formation of a cork on the cut surface. In addition, tubers were planted so as to have the cut come closest to the soil (cut downward), in order to effect a closer contact with the soil. The rest of the work in caring for both plots was the same.

The results of the infection of plants by black leg are presented in Table 1.

Table 1

VARIATION	Per cent of infected plants: Waste Land	Per cent of infected plants: Infected Plot
Planting of healthy whole tubers	0	1.1
Planting with diseased whole tubers	18.0	16.0
Planting with healthy cut tubers	0	1.0
Planting with diseased cut tubers	19.6	19.9

The data indicates that despite the severe infection of the second plot planted with both whole and cut healthy tubers, the percentage of diseased tubers was insignificant. The planting of diseased material, however, independent of the plot, produced a considerable amount of infected plants.

The experiment was repeated in the following year with two varieties, EPICURE and GREAT SCOTT, of which the tubers were planted on a plot severely infected with potato foliage and tubers decayed from black leg. The results were the same.

Our observations conducted on large industrial plantings of potatoes at the same experiment station also showed the close connection between the appearance of black leg in the field and the quality of seed material, i.e., its degree of infection. Varieties infected with black leg invariably produce a large amount of diseased plants, irrespective of the plot and its predecessors. At the Leningrad Potato Station potatoes were frequently distributed on a clover bed, where under the prevailing crop rotation ~~it~~ they were returned to the same plot no earlier than after 7 - 8 years. This long period, according to Iachevski, is ample for clearing the soil of infection, and the potatoes planted on such plots were not supposed to become infected by black leg. Actually, however, the degree of infection of several varieties planted on clover beds was significant, as seen from Table 2.

Table 2

VARIETIES	Per cent of infected plants
Belladonna	11.6
Wohltmann	3.8
Cobbler	6.5
Epicure	2.0

The difference in the degree of infection of varieties on this plot depended exclusively upon the infection by the seed material, since all the remaining conditions were the same and all varieties were equally susceptible to infection by black leg.

After examining hundreds of diseased plants we came to the conclusion that the infection of potato plants is only possible during the presence of the maternal tuber. Without it there is no infection. This explains the absolute non-infection of seedlings of the first year, as well as of potato seedlings. Our observations, confirming the above, are submitted in Table 3.

Table 3

VARIETIES	Per cent of infected plants		
	Planted in tubers	Pricked out	Not pricked out
Centifolia	6.1	0	0
Variety 421	8.3	0	0
Variety 414	2.8	0	0

The infection of potato tubers in the field may take place in different ways: bacteria may penetrate from diseased stems through stolons and young tubers, where they produce darkening and decay of tissues. The characteristic feature of such infection is considered the presence of a dark, depressed spot in the stolon part. An analysis showed that about 10 per cent of these tubers decay in the soil prior to harvesting, one part of them decaying during winter storage and thus constituting a source of infection for other tubers.

The infection of tubers may also take place through contact with diseased foliage during harvesting. In this case bacteria penetrate into tubers through various injuries. The result of the activity of bacteria is usually unobserved, but such tubers, when transplanted into the field, produce plants infected by black leg. This possibility of the infection of tubers was proved in the following manner: Tubers from healthy plants were taken; one group was mixed with the diseased foliage of potatoes, the other served as control. Both groups were stored under the same conditions. In the following year the results were as follows: tubers infected by contact with diseased foliage produced 52.9 per cent of infected plants, while the control grew completely healthy plants. The appearance in the field of plants diseased with black leg is observed throughout the vegetative period, from the time of sprouting to harvesting. An exceptionally wide spread is noted in the second half of summer.

Iachevski (1) indicates that during warm rainy weather the disease is widely distributed in plantings causing the destruction of plants within 3 to 4 days. He attributes this to the results of the secondary infection obtained from the spread of the disease through wireworms and other insects aboveground. According to data by Pronicheva (1) nematodes may also serve as disease transmitters since by injuring the tubers they facilitate the penetration of bacteria.

In order to verify the role of above-ground insects as potential transmitters of infection, we experimented on a plot possessing a rather thick population of wireworms. Healthy and diseased tubers were planted in one hill. Both healthy and diseased tubers were next transplanted alternately checkerwise. The infection of plants grown from diseased tubers equalled 15.7 per cent, the infection of clumps obtained from healthy tubers and transplanted into the same hill with diseased tubers, amounted to 0.5 per cent. No infection of plants was observed in alternating diseased and healthy tubers in checker order. In another experiment (on a plot planted with healthy tubers) artificial foci of black leg were created by planting diseased tubers. The infection of such foci amounted to an average of 27.8 per cent during the summer as compared with an infection of 1.3 per cent for the remaining plot. The appearance of black leg in the plantings was not limited to the foci alone, but was observed all over the plot, irrespective of their proximity. The possibility of the transmittance of black leg by underground insects may not be denied, although we believe that their role in the general picture of plant infection is not significant.

In examining diseased plants we became convinced that the period of appearance of black leg depends upon the rapidity with which the maternal tuber decomposes. Tubers in which decay is rapid and complete produce a large number of diseased stems and show the disease much earlier.

Rapidity of tuber decay depends in the first place upon meteorological conditions. It has been observed that in rainy years infection of plantings increases substantially as compared with dry years. Under Leningrad conditions the appearance of black leg proceeds more intensively during the second half of the vegetative period, usually associated with more abundant precipitation. The rapidity of tuber decay depends also upon the variety. Such varieties as Belladonna show early and close infection. Centifolia produces its largest number of infected plants towards fall. Apparently this is a matter of the physiology of the particular tuber and its resistance to decay.

On the basis of numerous observations we established that apparent traits of the disease (chlorosis, wilt, etc.), take place only when the entire above-ground part of stems is decayed and the clump practically destroyed. The entire period preceding the appearance of the disease remains unobserved. This period we named "hidden." Because of the hidden form of the disease, potato plantings always possess a certain degree of black leg infection which may appear in severe form during a rainy season when the decay of infected tubers and stems is particularly intensive (Table 4).

Table 4

Variety	Budding stage % of infected plants		Blooming stage % of infected plants		Harvesting % of infected plants	
	apparent form	hidden form	apparent form	hidden form	apparent form	hidden form
Great Scott	4.0	8.0	9.0	6.0	17.0	3.0

Thus black leg develops primarily not from secondary infection but as the result of its hidden state following a primary infection of tubers.

The cutting of planted material exerts considerable influence upon the increase of infection by black leg. By applying this method the infection of potatoes increases several times (Table 5).

Table 5

Varieties	Per cent of infected plants	
	Planting of whole tubers	Planting of cut tubers
Wohltmann	3.6	12.3
Majestic	2.4	11.5
Korenevski	1.9	11.6
Epicure	1.8	5.8
Great Scott	8.0	13.5
Rudzinski	3.4	10.0

Thus, by cutting tubers, among which there are also diseased ones, we are transferring the infection onto healthy tubers. By piling up cut material a still greater possibility for infection is created. Increases in temperature and moisture which are observed in these piles create particularly favorable conditions for the subsequent development of black leg.

Our estimate made in 1933 indicated that among a group of varieties planted with cut tubers, the number of plants which did not mature was considerable. One group of tubers perished without producing shoots, in others the shoots decayed before reaching the surface (Table 6).

Table 6

Variety	Percent of Precipitation	
	Planting with whole tubers	Planting with cut tubers
Variety 414	1.5	29.0
Korenevski	0	26.8
Cobbler	5.0	19.0

The cutting of tubers may prove harmful only in the event that the seed material if infected.

CONCLUSIONS

1. The principal source of infection of black leg lies in infected seed material. The influence of infected soil as a transmitter is not considerable.
2. Distribution of black leg under field conditions may take place during the caring of crops through implements. The possibility of contamination by above-ground insects is also not excluded.

3. The infection of seed material in the field may occur in various ways. Bacteria may penetrate through stolons from diseased stems into young tubers and produce an infection within the tuber bearing the characteristic symptom of a darkened, depressed spot in the stolon of the tuber. Bacteria may during harvesting also penetrate the outside tissues of the tuber, when in contact with diseased foliage, and not show any visible signs of infection.

4. The cutting of infected seed material is one of the principal factors severely affecting the degree of infection of plants by black leg and it is equally responsible for the reduction in yields.

End of Article

Literature:

1. A. A. Iachevski — "Bacteriozy of Plants," 1935 (Bacteriolysis)
2. N. A. Naumov — "Diseases of Garden and Vegetable Plants," 1935
3. N. A. Dorozhkin, L. N. Khrennikov, A. S. Ravdo — "Diseases of Potatoes and Methods for Their Control," 1934

Kazan Government Station
Delivered to publisher
May 4, 1947

2-23-51

Luk'ianov, M. I. Prevention of the spread of potato canker. Sad i Ogorod 1948 (9): 12-13. Sept. 1948. 87 Sal

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Translated from the Russian by
S. N. Monson

One of the results of the temporary occupation of the Ukraine during the war was the importation and the distribution in the Ukrainian Republic of a quarantined disease, that of potato canker.

The damage caused by this disease is exceptionally large. Infected areas remain unsuited for potato growing for many years. The most dependable method of stopping the development of potato canker is the production of canker-resistant varieties.

The Government Commission of varietal experimenting on potatoes, vegetable and melon fields, and forage root crops of the Ukrainian Republic arranged for the following regionalization of best canker-resistant potato varieties on the basis of three years of experimentation.

List by variety

For the Kiev, Chernigov, Zhitomir, and Kamenets-Podolsk oblasts - the varieties Frümel, Cobbler, Oktiabrenok (S-144), Yubel, Parnassia, Cornea, and Ostboat; for the Vinnitsa oblast - Frümel, Courier, Cobbler, Oktiabrenok (S-144), Yubel, Parnassia, Cornea, Ostboat, and Priska;

for the Chernovitskaya oblast - Frümel, Oktiabrenok (S-144), Yubel, Parnassia, Grenzmark, Cornea, Ostboat, and Priska;

for the Kherson, Nikolaev and Izmailsk oblasts - Courier, Cobbler, Oktiabrenok (S-144), and Grenzmark;

for the Odessa oblast - Courier, Cobbler, Oktiabrenok (S-144), Lichtblick, and Grenzmark;

for the Stanislavsky oblast - Frümel, Oktiabrenok (S-144), Yubel, Parnassia, Grenzmark, Cornea and Ostboat;

for the Drogobychsky, Lvov, and Ternopolsky oblasts - Frümel, Oktiabrenok (S-144), Yubel, Parnassia, Phytophthora-Resistant (S-8760), Grenzmark, Cornea, Ostboat;

for the Rovno and Volyn oblasts - Frümel, Cobbler, Oktiabrenok (S-144): Yubel, Parnassia, Grenzmark, Cornea, and Ostboat.

In order to establish seed funds of the most valuable canker-resistant varieties of potatoes in other oblasts of the Ukraine, the Government Commission recommends to propagate these varieties in amounts adequate to meet the demands of the areas of seed plots in 1950. For the Stalin, Voroshilovgrad, Zaporozhie, Dnepropetrovsk and Kirovograd oblasts - the varieties Courier, Cobbler, Oktiabrenok (S-144) and Grenzmark;

for the Poltava, Sumskaya and Kharkov oblasts - Frümel, Oktiabrenok (S-144), Lichtblick, Grenzmark, Cornea, and Priska.

For the dried swampy areas of bottom and low lots (the zones of the Polessie and forest-steppe) the Government Commissioh recommends the following canker-resistant varieties of potatoes: Frümel, Oktiabrenok (S-144), Yubel, Berlichingen, Cornea and Vekeragis, and of varieties non-resistant to canker: Epron, Stakhanovets (S-3593) and Polesski (S-36), as varieties producing the highest yield under those conditions.

For the Southern Ukraine it recommends the canker-resistant varieties Courier, Cobbler, Oktiabrenok (S-144) and Grenmark, and for dried swampy areas, bottom and low-lands the non-resistant to canker variety Epron is made

Epron as well.

The yield of regionalized canker-resistant varieties of potatoes in the Ukraine varies within the following figures for the three post-war years (in centners per hectare) - Frümel from 133 to 279, Courier from 102 to 170, Cobbler from 106 to 200, Oktiabrenok (S-144) from 165 - 230, Lichtblick from 160 to 240, Yubel from 182 to 277, Grenzmark from 219 to 459, Cornea from 182 to 381, Ostboat from 182 to 269, Phytophthora-Resistant (S-8670) from 214 to 264, Priska from 215 to 380.

In 1947, at 4 Ukrainian collective farms the following areas were approved and accepted as varietal, that were planted with potatoes of canker-resistant regionalized varieties (in hectares):

Frümel - 3.5; Courier - 425.8; Cobbler - 89; Yubel - 3.166.8, Lichtblick - 24.5; Berlichingen - 4, Priska - 638, Parnassia - 6,675.7; Cornea - 611.7; Ostboat - 115;

Sowings of other canker-resistant varieties of potatoes were also passed upon by approvers.

In the Spring of 1948 the Experiment Selection Stations of the Ukraine transmitted to seed nurseries of collective farms, 1,460 centners of elite canker-resistant varieties of potatoes.

In 1948, all spring sowing of non-resistant to canker potato varieties was prohibited on farms located in populated areas, known as nidus (nidi) of potato canker, as well as on farms which closely adjoined those populated areas. A plan for the summer planting of potatoes of canker-resistant varieties was established for collective farms, peasant households and lots adjoining farm lands, as well as for privately owned gardens of workers and officials, which represented 900 hectares altogether.

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Beginning January 1, 1948 eighty control border quarantine posts were established in the Western oblasts of the Ukraine at principal points of communication. Chemicals were brought into locations where potato canker was prevalent.

The threat of the distribution of potato canker obligates Soviet agricultural organs, agronomists and collective farmers to keep account of all available sowings of canker-resistant potato varieties and use them for seed~~l~~ing purposes.

End of Article

Government Commission on varietal testing of potatoes, vegetable and melon crops and forage root crops of the Ukraine.

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Luk'ianov, M. I.
Prevention of the Spread of Potato Canker.
Sad i Ogorod 1948(9):12-13. Sept. 1948. 80 Sa13

Translated from the Russian by
S. N. Monson

One of the consequences of the temporary occupation of the Ukraine during the years of the Patriotic War (World War II) is the introduction and spread in the Ukrainian SSR of the quarantined disease-potato canker.

The harm done by this disease is exceptionally great; plots affected by it remain for years unsuited for potato cultivation. The safest method of preventing the development of potato canker is the production of canker-resistant varieties. The Government Commission on Varietal Testing of Potatoes ("Goscommissia"), Legumes and Forage Root Crops of the Ukrainian SSR has approved for regionalization the best canker-resistant varieties of potatoes on the basis of three years' experimentation. For the:

Kiev, Chernigov, Zhitomir and Kamenets-Podolsk oblasts: varieties Frümelle, Cobbler, Oktiabrenok (S-144), Jubel, Parnassia, Cornea and Ostbote;

Vinnitsa oblast: Frümelle, Courier, Cobbler, Oktiabrenok (S-144), Jubel, Parnassia, Cornea, Ostbote and Priska;

Chornovits oblast: Frümelle, Oktiabrenok (S-144), Jubel, Parnassia, Grentsmark, Cornea, Ostbote and Priska;

Kherson, Nikolaevsk and Izmailsk oblasts: Courier, Cobbler, Oktiabrenok (S-144), and Grentsmark;

Odessa oblast: Courier, Cobbler, Oktiabrenok (S-144), Lichtblick, and Grentsmark;

Stanislav oblast: Frümelle, Oktiabrenok (S-144); Jubel, Parnassia, Grentsmark, Cornea, and Ostbote;

Drodobych, Lvov and Tarnopol oblasts: Frümelle, Oktiabrenok (S-144), Jubel, Parnassia, Phytophthora-Resistant (S-8670), Grentsmark, Cornea, Ostbote;

Rovno and Volyn' oblasts: Frümelle, Cobbler, Oktiabrenok (S-144), Jubel, Parnassia, Grentsmark, Cornea, Ostbote.

In order to create seed funds of the most valuable canker-resistant potato varieties in other oblasts of the Ukraine, the Government Commission recommends the propagation of these varieties in a volume which would provide for seed plot areas by 1950. The following varieties were regionalized for the Stalin, Voroshilovgrad, Zaporozhie, Dnepropetrovsk and Kirovograd oblasts: Courier, Cobbler, Oktiabrenok (S-144), and Grentsmark;

For Poltava, Sumy and Kharkov oblasts: Frümelle, Oktiabrenok (S-144), Lichtblick, Grentsmark, Cornea, Priska;

For the drained, swampy plots of bottom lands (Polessie and forest-steppe zones), the Government Commission recommends the following canker-resistant potato varieties: Frümelle, Oktiabrenok (S-144), Jubel, Berlichingen, Cornea, and Vekeragis, and from among the non-canker-resistant varieties: Epron, Stakhanovets (S-3593) and Polesskii (S-36), as those bringing the highest yields under local conditions.

For the southern Ukraine the canker-resistant varieties Courier, Cobbler, Oktiabrenok (S-144) and Grentsmark are recommended; while for the drained, swampy plots on bottom lands also the non-canker-resistant variety Epron.

The yield from regionalized canker-resistant varieties within the boundaries of the Ukraine varies within the following limits (centners per hectare) in the three post-war years: Frümelle from 133 to 279, Courier from 107 to 170, Cobbler from 106 to 200, Oktiabrenok (S-144) from 165 to 230, Lichtblick from 160 to 240, Jubel from 182 to 177, Grentsmark from 219 to 459, Cornea from 182 to 381, Ostbote from 182 to 269, Phytophthora-Resistant (S-8670) from 214 to 264, Priska from 216 to 380.

The following canker-resistant regionalized varieties have been approved for the collective farms of the Ukraine in 1947 (in hectares): Frümelle 3.5; Courier 425.8; Cobbler 89; Jubel 3,166.8; Lichtblick 24.5; Berlichingen 4; Priska 638; Parnassia 6,675.7; Cornea 611.7; Ostbote 115. Approved were also plantings of other canker-resistant varieties.

In the spring of 1948, 1,460 centners of elite canker-resistant potato varieties were transferred from experiment selection stations of the Ukraine to seed nurseries of collective farms.

In 1948 spring plantings of potatoes of non-canker-resistant varieties were prohibited on farms located on territories of populated regions recognized as focuses for potato canker, as well as on farms immediately adjoining these populated sections. A schedule of summer potato plantings of canker-resistant varieties was established for collective and peasant farms, for individual plots of collective farmers and the private gardens of employes and workers, representing a total area of 900 hectares.

Beginning January 1, 1948, eighty control quarantine posts were established in the western oblasts of the Ukraine on the main roads of communication. Chemicals were brought into the sections infected by potato canker.

The threat of the spread of potato canker obligates Soviet agricultural organizations, agricultural specialists and collective farmers to estimate their supplies of available canker-resistant potato varieties and use them for seed purposes.

Government Commission on Varietal Experimentation on Potatoes, Legumes and Forage Root Crops in the Ukrainian SSR.

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Rozhdestvenski, N.
In Selskokhoziaistvennaia entsiklopediia
[Agricultural Encyclopedia]. vol. 3
Moskva, 1934.

Translated in part by
S. N. Monson

POTATO DISEASES AND THEIR CONTROL (p. 27-31)

The tubers and leaves of the potato are easily infected by many fungi and bacteria which cause potato disease. The principal diseases and those causing the greatest harm are listed in table 4 (p. 29-30). (This table - in photostat form - is attached).

In the years of the greatest distribution of diseases of the potato, losses in yields reach 50 percent; one half of all these losses results from the potato disease caused by phytophthora. In addition, the tubers infected by phythophthora easily succumb during their winter storage to fusarium and bacterium, which occasionally completely destroys potatoes (see the spread of phythophthora in the past years on p. 29-30). Smaller losses in yield in the central belt and a drastic reduction in yield in the South are produced by a group of virus diseases. At a high rate of damage by virus diseases (crinkled mosaic and curly top) even a complete destruction of sowings is possible. These diseases are transferred from year to year by seed material. Other diseases are not ~~of~~ as destructive but the harm they cause may be considerable in some areas.

A pathological condition called "kudriash" (leaf roll), which alters the appearance of the plant (in severe cases its leaves lose their incisions (?) ["rassechennost"] and only the end lobe remains which greatly increases in size). Leaf roll reduces the yield of commercial tubers considerably.

Rozhdestvenski, N.
Potato Diseases and their control.

In order to control phytophthora, it is necessary to spray the potato plant with the Bordeau mixture at the first sign of a disease. Repeated spraying increases the yield 10-20 percent, as compared to the non-sprayed potato. If the leaves of the potato plant carry traces of disease at the time of harvest, they have to be cut and removed from the field 7 to 10 days prior to harvesting, otherwise they will transmit the phytophthora to the tubers.

Finally the replacement of non-resistant varieties (for instance, Early Rose, People's) with varieties of higher resistance (Loroh, Woltman) also helps in controlling phytophthora.

To control virus diseases (Bacterium solanacearum and leaf roll) the diseased plants have to be pulled out from the rows, especially on lots of seed plantings and on seed farms.

To control Rhysoctonia, scab and Bacterium solanacearum, it is necessary to plant potatoes in such rotation that they should not return to the same location any earlier than every two years or even the third. There is no potato cancer in the USSR.

The principal enemy of the potato is the Colorado beetle, spread in the USA, but not found in the USSR. In order to prevent the introduction of cancer, the Colorado beetle and other diseases and parasites to potato areas, the quarantine administration of the NKZ of the USSR has established control procedures for a potato quarantine which were confirmed by the Collegium of the NKZ of the USSR , dated May 19, 1932. According to these regulations the potato provided with a certificate is permitted to be imported from abroad only at specific points where it is subjected to special inspection.

In border areas special cancer-resistant varieties of potatoes are selected for propagation, such as "Yubel," "Greatscott," "Parnassia," etc.

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End of article.

Shchegolev, V. N.
Sel'skokhoziaistvennaia entomologiia; vrediteli sel'skokhoziastvennykh kul'tur i mery bor'by s nimi [Agricultural entomology; pests of farm crops and measures for their control]. Ed. 2, rev. and enl. Moskva, Sel'khozgiz, 1949. 764 p. 423 Sh2S

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Translated in part by
S. N. Monson

POTATO PESTS (p. 597 - 603)

Over 60 species of insect-pests of potatoes have been identified in the USSR, but the largest majority of these are accidental and non-specialized. Pests specific to potatoes ("specializirovannye") have so far not been discovered in the USSR.

Of primary importance are insects which injure the roots of potatoes. Among these are wireworms which represent harmful pests; tubers damaged by them are not destroyed but are ill suited for table use and unsuited for prolonged storing.

The second group covers the above-ground sucking insects. They have little effect upon the ultimate yield but act as transmitters of various, chiefly virus, potato diseases, i.e., leaf roll, mosaic, etc. The green grass bug and different species of cicadas are constant inhabitants of potato plants and their role as transmitters of virus diseases has not been taken into account sufficiently.

The third group are the leaf-gnawing insects and carry little significance. Fleas and primarily caterpillars of highly-poisonous butterflies are found on potatoes. They are seldom found on potato plants in mass quantities. Among this group only the 28-spot potato ladybird (Epilachna Vigintio Punctata F.)

is of significance as a pest in the Far East. Stem pests occasionally cause damage to potato plants by injuring the inner part of the stem; i.e., swamp stem borer.

Thus the fauna of potato pests in the USSR differs radically from the fauna in other countries, particularly that of America, the birthplace of the potato plant, where many dozens species of insects live on it as parasites and of which many represent pests specific to Solanaceae. The introduction of these pests into the Soviet Union should be watched out for and in this connection the potato quarantine acquires great significance. Among insects which carry particular importance for quarantine is the especially dangerous Colorado Potato Beetle and the Potato Moth.

COLORADO POTATO BEETLE - Leptinotarsa decemlineata Say
(Coleoptera, Chrysomelidae)

The Colorado beetle or, as it is also called, the potato leaf-eater (Illus. 221, p. 599) is the most dangerous potato pest. It does not exist in the USSR. It represents a quarantine object. The beetle is of short-oval shape, pronounced bulging, shiny, vividly colored, reddish-yellow with lighter upper wings, and dark spots on the head and front back. Each upper wing has five black stripes. Its length is 9-12 mm. The eggs (larva) are almost smooth, shiny, reddish-yellow to light orange and orange in color, elongated-oval with rounded ends. Length, 0.8 mm.

The larva is flat below and protruding above; the body is particularly bulging in the central part, fleshy, viscous, sparsely covered with hair. The basic coloring of the body is at first orange-red, gradually turning orange-yellow.

The head, front part of back, the elongated rows of warts on each side of the body, the last tergites of the belly, and the legs are black. The adult larva is pear-shaped, slightly curved. Length 15-16 mm.

The pupa is free, of pink or orange-yellow color,, reproduces the shape of the beetle. The birthplace of the pest is Mexico, where it dwelled first on the spiny Solanum rostratum [buffalobur] with which it slowly spread northward. In 1824 it was described as found in the Rocky Mountains of North America, but did not appear to be harmful at that time. In the early forties when pioneers were turning westward and planting cultivated potatoes, the potato beetle slowly spread from the west. In the late fifties the meeting of the beetle and the potato took place in the State of Colorado (hence the name given the pest. From that time on its rapid distribution and dangerous effect became known in America. Within 16 years it spread to the Atlantic Ocean, traveling 3,000 miles (moving at the rate of 185 km. a year) and penetrated into Canada. Beginning with the seventies the beetle was repeatedly brought into Western Europe (Germany, England and Holland), but these countries usually managed to destroy it.

During the First World War the beetle was carried into France (through the port of Bordeaux). From that time on it became acclimatized in Europe and moved, traveling at the rate of 160 to 400 km. a year, all over France (1918-1938), Belgium (1935-1938), Switzerland (1935-1941), Luxemburg (1936-1938), Germany (1936-1946), Holland (1937-1940), penetrating even into Spain (1935), Portugal (1943), Czechoslovakia, Yugoslavia, Italy, England and Poland. Thus, at present, the beetle has come close to the boundaries of the USSR.

The basic food plant of the beetle and its larva is potatoes; it feeds in addition on eggplant, tomatoes, and among the wild growing plants, on black, spiny (buffalobur) and bittersweet nightshade and several other representatives of the Solanaceae family.

The beetles winter. In the spring they leave their wintering dwellings at different periods, depending upon climatic conditions, as well as the structure, temperature and moisture of the soil.

High temperatures contribute to their early appearance on the soil surface, i.e., early and middle of April. As soon as it appears, the beetle begins to feed, with particular avidity during sexual activity. Following a rather lengthy period of additional feeding it mates and begins to lay eggs. Both fertile and sterile eggs are laid but the latter do not develop. In the warmest periods the beetles fly distances of tens and hundreds of meters, even kilometers. Mass flights take place in dry and warm years; the rapidity of a flight reaches 8 km. an hour. Egg laying, which usually takes place a month after the beetles leave their wintering abodes, lasts throughout the entire vegetative period. Eggs are laid on the lower part of potato leaves, eggplants, tomatoes, tobacco and other solanaceae, and are placed in heaps of 25-30 at one time. The total fecundity of a female averages 500 eggs, but there are cases when one female lays over 1,000 eggs.

The embryonic development depends upon temperature and moisture; at 18°C. eggs hatch in 5 days, at 12° in 17 days, at a temperature below 12° egg laying does not take place, nor do eggs develop.

The larva begins to feed on leaves immediately and completes its development within 15 to 22 days. Pupation takes place in the soil, close to the roots of plants, at a depth of 10-12 cm.; 7 to 8 days later the beetles emerge. The life duration of a beetle averages 12-14 months; some specimens may live two years. During the summer the beetle may be found on potatoes in all stages of their development. Within one year one to three generations may develop.

The beetle and larva are both injurious. One hundred larva can destroy up to 80 hectares within one month, while 100 beetles within the same time will injure 424 hectares of foliage. Beetles may however live through considerable starvation periods; this should be taken into account in appraising the pest as a quarantine object; for instance, beetles which were not given anything but water stood this diet for 11 months.

The rapidity with which the Colorado beetle spread in the USA testifies to its vast capacity for active settlement; it spreads equally fast in a passive way; cases of the transmittance of a beetle by man through clothing or their introduction by various means of transportation, wheel wagons, boats, steamships, automobiles, agricultural implements, i.e., spades, rakes, are not infrequent. Domestic and wild animals may also contribute to the transporting of beetles, especially the long-haired specimens. Of considerable importance for its distribution is running water, but the greatest danger lies in introduction through soil wherein there are beetles, larva and pupae.

In the USSR the Colorado beetle could, judging from its areal distribution in the USA and Europe, if introduced, get acclimatized in the Crimea, the Caucasus, Central Asia, the Ukraine, and even some of the northern regions.

The above makes quarantine measures in the USSR highly advisable.

METHODS OF CONTROL: For the USSR quarantine measures and complete embargo on the importation of potatoes, the prohibition of the importation of rooted plants with soil, and the most careful examination of everything that is imported from countries infested by the beetle are basic requirements. Since the possibility of introducing individual specimens of the pest into the USSR and the formation of isolated focuses is not precluded, it is imperative that careful observation of potato plantings, particularly in regions adjoining the Western boundaries, be made to cover literally every planted area. It is essential to acquaint the population, of villages primarily, with the Colorado beetle through the medium of films, radio, press, etc.

DDT is used among insecticides for the destruction of the beetle and its focuses to spray the above-ground parts of plants, as well as calcium arsenate, Paris green in common dosage; for the treatment of soil carbon bisulfide (20 g/m^2), dichloretan, and watering of the soil on the infected territory with poly-chlorides of benzol.

To eliminate the focuses of the beetle all quarantine measures established in the special instructions of the Department of Agriculture of the USSR have to be followed.

POTATO MOTH - Phthorimaea operculella Zell

(Lepidoptera, Gelichiidae) (P. 601-603)

The butterfly is silver gray, with dark spots on the back border of the front wings are fringed, shorter and narrower than the front wings. The belly yellowish-ash-gray on top and grayish-white below. The male has at the base of the last segment of the belly a clump of hair along the sides. Wing spread of the butterfly is 12 to 16 mm.

The egg is oval, pearl-white in color, size 0.36 mm.

The caterpillar cream-white, rose or green, its head dark brown; size to 12 mm. in length and 1.5 mm. in width. At the base of the prolegs ("lozhnye") a black thorax projection with three bristles ("shchetinki") in a row. On the second segment of the belly the third bristle moves towards the belly. The pupa is in a silver-gray cocoon (Illus. 222, p. 602).

Distributed in America, Australia, Africa, Asia (India) and the islands adjoining the respective parts of the world, as well as in Italy, Spain, France, Portugal. It causes damage to potatoes, tobacco, tomatoes, and other solanaceae.

The potato moth acts as a potato pest under field and storing conditions. In the latter it propagates constantly if the temperature and moisture are conducive to it. Under natural conditions the moth flies out in early spring and is active usually in the evenings and at night. The butterfly deposits two to three eggs on the lower surface of potato leaves and other solanaceae. In storage it lays its eggs in heaps, principally over the eyes of tubers.

Caterpillars emerge after 5 to 30 days from eggs; at a temperature of 27°C. the entire cycle of development is completed within 25 days. In the southernmost parts of its areas of distribution the moth may produce from 6 to 8 and more generations.

Under field conditions the caterpillars injure the above-ground parts of plants; they bore into the leaves and undermine them; also injure the petioles, stems and fruits (tomatoes and eggplants). In storage they make pathways within the tubers; a few days afterwards a pink coloring on the tuber marks the place of their penetration. The damage caused in the fields is relatively much smaller than that caused to potatoes in storage where caterpillars have full opportunity to destroy the tubers. The potato moth as a pest is second only to the Colorado beetle in damage caused to potato plants.

METHODS OF CONTROL are very difficult. In countries where the moth has had the opportunity to develop deep planting of potatoes (15 to 25 cm.) is recommended, destruction of weeds, especially black nightshade, early harvesting before the drying out of potato foliage, and the destruction of the latter. Gathered potatoes are immediately transported from the field. It is not permissible to cover them with foliage. All potato residue, foliage, injured tubers, should be immediately destroyed after harvesting.

Among the most effective chemical methods are fumigation of potatoes with carbon bisulfide (3 g/m^3) and exposure for forty-eight hours at a temperature of 20-22°; at a temperature below 15° there may be no fumigation. During the winter two to three fumigations are made.

When discovered, the pest should be immediately destroyed, together with the plant, as should all weeds of the Solanaceae family.

End of Chapter

3-5-51

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Sigrianskaia, N. D. [Author is a "candidate" in agricultural sciences; equivalent of MS degree.] Resistance of varieties to potato canker. (In Russian). Sovet. Agron. 1947 (6): 92-93. June 1947. 20 So84

Translated from the Russian by
S. E. Monson

Canker is an extremely harmful potato disease. In the countries where none is known radical quarantine measures are undertaken to prevent its introduction or to localize its loci, aiming at eventually eliminating it.

Until recently the production of canker-resistant varieties was considered the safest and most efficient method for controlling potato canker. The problem of controlling the disease appeared relatively uncomplicated, so long as it was thought that the inducer of canker lacked biological races.

Towards the end of 1942, the oldest German phytopathological journal, the Zeitschrift für Pflanzenkrankheiten, (vol. 42, No. 11) published an article by Ch. Braun in which reference was made to biological specialization in the inducer of potato canker, the fungus Synochytrium endobioticum (Schilb.) Pers. Braun stated that in Thuringia, in the town of Gissübler, canker had appeared on the German "canker-resistant" varieties EDDA and OSTBOTE, the purity of which was considered beyond doubt.

In control experiments of artificial infection undertaken at the Government Biological Institute (Berlin-Dahlem) of the infectious material from Gissübler, these facts were confirmed. The race G. (Gissübler) proved extremely virulent and almost all varieties succumbed to it which up to that time had been considered canker-resistant. Only two varieties proved resistant, FRAM and FRÜHE HÖRNCHEN. The segregation of biological races in the inducers of potato canker, along with the reference concerning the particular aggressiveness of race G., which affected varieties certified by Government varietal testing, (in these experiments 148 varieties were affected out of a total of 165 "canker-resistant" varieties) evoked considerable and understandable excitement among selectors, specialists and practical potato growers.

In 1943 appeared an article by Dr. Schlümberger - "The Authenticity of Experiments of Potatoes to Canker-Resistance" (Forschungsdienst, vol. 16, No 5), which briefly cited the course of experimentation on potatoes for canker-resistance. The object of the article was to prove that data concerning the possibility of infection of varieties by canker, certified as canker-resistant in Germany, should not shake faith in the results of government experiments in potato varieties with regard to their resistance to canker.

The segregation of biological races in inducers of potato canker is not to be viewed as something extraordinary, since in recent years considerable variations in the degree of infection had been occasionally observed during tests. This had led to the belief in the possibility of biological specialization in this fungus as well. The appearance of this particularly aggressive race of a gradually increasing virulence is easily understood in a mountainous region of very high humidity, and in small individually-owned households which grow potatoes year in and year out on the same locations.

The experiments for canker resistance were conducted simultaneously at many points; in Germany at Dahlem near Berlin, at Münster and Lübeck; in Britain at Ormskirk, Phillipstown near Edinburgh (Scotland) and at Kilkiel in Northern Ireland. A variety was considered certified for canker-resistance only when the results at all these centers corresponded on every point.

In 1931 the Polish researchers Leshchenko and Garbovski (Works of the Department of Plant Diseases of the Government Agricultural Institute of Bydgoshchi) pointed to the circumstance that canker had been introduced into Poland from Germany. Its spread in Poland and especially in Germany was caused by the production and distribution of not immune but pseudo-immune potato varieties to canker, as a result of which Germany became the locus for the distribution of potato canker on the European continent. This is explained by a laxity in the approach to the evaluation of the resistance of potato varieties to canker.

The application of a more "minute" method in laboratory experiments (P. Glynn - "Infection by Summer Sporangia") which permitted the discovery of the initial stages of canker infection, established that many varieties considered until then immune to canker did not actually possess this immunity.

In Britain control experiments of varieties, considered canker-resistant, confirmed this factor in the majority of cases. In Germany, they did not desire to take into consideration the results of control experiments of a more detailed nature, and in their official listings of varieties recommended as canker-resistant, varieties susceptible to canker continued to be listed.

In connection with the fact of the absence of canker resistance in many varieties, listed as canker-resistant in official listings Germany began to distinguish among "fully resistant", "almost resistant" and susceptible varieties. As the result of the distribution of the "fully canker-resistant" varieties, canker was spread all over Germany.

For Germany, almost entirely infected by canker, it may possibly not have had any significance, since under those conditions the matter of obtaining high yields was paramount and could be ensured by the production of lightly susceptible varieties. The problem was entirely different in other countries where there was no canker and where it was of the utmost importance to prevent its penetration. For those countries and areas the situation with regard to potato canker, as created in Germany, should serve as a serious warning.

Polish authors provide a list of 37 pseudo-immune varieties.

The works of Leshchenko and Garbovski on experiments on canker-resistance of potatoes are rather outdated at present (1931-1932) but they preserved their significance ("actualnost") since prior to the war, canker loci in the USSR were restricted only to the Western Ukraine, and at that to very few places. At present it is necessary in testing potatoes for canker-resistance to consider another most significant factor, the presence of the biological race in the fungus.

In Germany infection occurs, as evidened from the article by Dr. Schlümberger, in tests on canker-resistance by the mixture of infectious material from different infected locations in Lübeck, Münster or Dahlem (the Dahlem mixture being the most aggressive). Consequently, one may not speak of tests on the canker resistance of a variety, with reference to a single race, since a mixture is responsible for its infection.

In confirmation of the correctness of the method accepted in Germany, Dr. Schlümberger mentions that during tests on phytophthora-resistance the work is also conducted with a mixture of infectious material of different origin and that the particularly aggressive race (Stamm S) is not being considered.

It is further indicated, however, that newly produced varieties must be tested separately on their resistance to the race G. (Gissübler), since some potato varieties have proved resistant to this race.

It may appear that in mass experiments conducted for production purposes it may only be important to establish whether the given variety is susceptible to canker and that it may not be important by which of the races, that had entered into the compound of the mixture, it is affected.

In practice this may not be the case. It is possible that canker races, as do the phytophthora races, will differ slightly from each other in their respective virulence. But if among phytophthora races in Germany there is an especially virulent race S, while ours will be the Arzamasskaia, then the race Gissübler in canker will be the more aggressive. There exists the danger that when working with a mixture of races, individual races may be overshadowed.

The correctness of the method must be established experimentally by studying the virulence of the races separately and in mixtures.

The results of the unsuccessful control of potato canker in Germany should be taken into consideration in our country with regard to selection and tests of potatoes on canker-resistance.

- End -

1/22/51

Simakina, V. A.
On Wilting of Potato Plantings
Sad i Ogorod 1950(7):74-75. July 1950. 80 Sa13

Translated from the Russian by
S. N. Monson

In the May issue of "Sad i Ogorod," 1949, in his article on "Potato Degeneration and Methods of Controlling it in the South," the author, V. V. Arnautov expressed the opinion that potato wilting is caused by the stifling of the root system of potato plants, the result of an extremely close-grained and saturated soil.

Our experiments conducted in 1949 at the Sunzhen Experiment-Meliorative Station (Grozny oblast) established that the principal cause for potato wilt in summer plantings is their reaction to high temperatures. Date concerning the potato yield of the variety LORKH for the different periods of summer planting is furnished in the table below.

Dates of Planting	Yield In c/h	Yield In per cent
June 20	0.5	0.0
July 1	14.8	8.6
July 10	33.5	19.6
July 20	171.2	100

The soil was well prepared for all variants of the experiment and all plantings were given the most attentive care. The plot designated for the experiment was autumn plowed to a depth of 25 cm.; in early spring it was harrowed in two rows ("sledy") and several days later (April 8) gone over with a tractor with web-footed (?) ("lapchaty") cultivator; on May 15 it was cultivated again and in another month fertilized with super-phosphate (5 centners

Declassified and Approved For Release 2013/03/22 : CIA-RDP80R01426R009900020001-4

per hectare), and the soil again plowed to a depth of 20-22 cm. The plots of all variants were watered 2 to 3 days before planting and as they grew dry ammonium sulfate (3 c/h) and potassium salt (potash) (2.25 c/h) added; then the soil was cultivated to a depth of 16-18 cm. with a horse-driven spring (coil) cultivator and harrowed. Vernalized whole tubers of medium size were planted under the spade. All variants showed good close growth on the 11-12th day after planting. During the vegetative period the plots were watered, cultivated between rows and weeded. Despite the good preparation given the soil and the thorough care accorded the plantings of potatoes, the variants of the first three periods showed mass infection by wilting and produced a poor yield. The first period of planting failed to produce any yield.

The variant of the fourth period of planting did not show any wilt and produced the highest yield.

On the basis of this experiment it is possible to draw the conclusion that wilting of potato plantings occurs generally under the influence of high temperatures.

Proper periods of summer planting, combined with other agricultural methods ensure a significant increase in yield under southern conditions.

End of article

Sunzhen Experiment Station
Grozny Oblast

Editorial Remark:

The problem of causes of potato wilt has not been solved. We agree with Comrade Simakina concerning the importance of high temperatures as basic factors causing potato wilt but consider that under definite conditions the strangling of the root system is also of significance in the distribution of the above disease. The most careful observation of the entire complex of agricultural methods is an essential requirement for controlling potato wilt.

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R-65

Sukhov, K. S., and Vovk, A. M. New data on stolbur of potatoes. (In Russian). Sovet. Agron. 5(4): 72-75. Apr. 1947 20 So84.

Translated from the Russian by S. N. Monson

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Having in 1921 studied the problem of potato virus diseases in the USA, Iachevski began his observations in the USSR and came to the conclusion that crinkled mosaic was the principal cause of potato degeneration in the USSR. His conclusion was based on his knowledge of the cultivation of the potato in the central oblasts of the European USSR, but the potato degeneration which prevailed in the southern regions of the country remained outside of his field of observation. In the meantime the idea of the decisive significance of crinkled mosaic in potato degeneration was generally accepted by phytopathologists and in explanation of the degeneration of the southern potato as well.

The argument concerning the nature of the degeneration of the southern potato, begun in the 30's between Lysenko and the phythopathologists, resulted in recogniging the considerable gap which existed in our phytopathological science. Lysenko claimed that in the south many varieties of potatoes degenerate within a short time after repeated reproduction even without the evidence of crinkled mosaic. In accepting a high temperature of the soil during tuber formation as the principal reason causing degeneration, Lysenko proposed to use the method of summer plantings as a practical measure to control the situation. The phytopathologists, however, attributed the beneficial effect of summer plantings to the change in conditions unfavorable to the spread of mosaic.

We have in the past two years conducted a study of virus diseases of the southern potato which established that Lysenko had been right in his main point.

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Our research proved that for a series of varieties, such as Lorkh, Woltman, Korenevski and a few others, crinkled mosaic is a factor of secondary importance; still, these varieties degenerate in the south after one to three years. As shown by our experiments, the potato variety Lorkh, consistently grown near Krasnodar, was "freed" of crinkled mosaic in five years, but in spite of this almost all plants degenerated. The problem of controlling crinkled mosaic has since been solved by our selectors who produced the variety Lorkh but the struggle against the degeneration of the southern potato has yet to be won. Such varieties as Early Rose and Epicure, most susceptible to crinkled mosaic, suffer more from it under southern conditions because they react more strongly yet to the new, powerful factor of degeneration which exerts a damaging influence even upon varieties resistant to mosaic.

This new factor is the virus big bud ("stolbur"). It was first identified by us in 1945. In periods of severe epiphytotic diseases infection by big bud of such Solanum crops as tomatoes, peppers and eggplants amounts to 100 percent. Sections where the quantity of diseased tomatoes amounts to 25-30 percent are considered safe. The big bud virus is not transferred by seeds. The degree of infection of annual plants depends therefore upon a variety of conditions which control the preservation of the virus in weeds and the propagation of its carrier - the cicada. The situation is different in the case of the potato. As established by us, the big bud virus is transmitted through tubers to succeeding vegetative generations. This leads to the fact that in regions of an "average" distribution of big bud, potatoes degenerate altogether in the course of two to three years. During severe epiphytotic diseases identical results may be obtained within one year of reproduction.

A similar picture is observed on potato seedlings during the first year of their growth from seeds. In this instance the term "degeneration" is difficult to apply, since under degeneration one usually understands the gradual reduction in quality of an organism which occurs under the continuous influence of negative factors.

In appraising the conditions of reproduction in the case of the southern potato, no one could take that particular disease (big bud) into consideration. Its harmful effect entered into the general evaluation of potato degeneration from ecological causes.

We consider the main task of research in the nearest future to be the separation of these two factors and the establishment of the independent role of either, with respect to potato degeneration in the southern USSR.

The data we have at present permits us to review several problems connected with summer plantings of potatoes in the south. The tentative information we secured concerning the periods of carrier migration, relating to the distribution of the potato virus "big bud" among potato sowings and other crops, prove that the most dangerous months are those of June and July. The duration of this period may change, depending upon the weather. In 1945, during a moist and cold spring, the development of the carrier was delayed. The planting of potatoes done on June 25 proved infected by big bud 50 percent. Active Hyalesthes obsoletus could be found even in the beginning of August. In 1946 spring was early and hot. The winging and migration of the vector took place earlier and as a result June sowings showed a low percentage of attack (about 3). A considerable lowering of the degree of infection was observed on control plantings and other Solanum crops. Pepper, planted June 20 was infected 7.2

percent, eggplants 2.4 percent, tomatoes 7.8 percent. Tomatoes planted in early August were infected only 0.7 percent, while plants adjoining the plantings of of this crop, planted in May, were infected 20-25 percent by big bud.

This data proves that in years of an early development of the vector, the potato summer plantings are preserved from considerable infection. In the Krasnodar territory June 25 is considered the period for planting seed potato of medium and late ripening. But in years of a belated development of the vector, this planting period proves unsatisfactory.

The variety Woltman which we studied is a late variety. When planted on June 25, its tuber formation took place at comparatively low temperatures of the soil and as a result one did not expect a "catastrophic" degeneration of its tubers from ecological causes in the first year of its production in the south. Nevertheless, this variety degenerated 50 percent in 1945 because of big bud. This example provides an explanation for the fact that in some southern regions potatoes planted in the summer, drastically degenerate. The premature wilting of the leaves is a characteristic symptom of the appearance of big bud on potatoes. Novikov and Bordiukova point out that " with the spread of summer plantings of potatoes, beginning 1937, it was learned that the premature wilting of leaves was observed on summer plantings in the south". In many southern regions premature wilting of summer planted potatoes represents the most harmful type of disease. Observations have proved that diseased plants frequently do not form tubers or only a small quantity of tiny tubers. A considerable spread of premature wilting is observed on summer plantings in the Ordzhonikidze territory where it caused much damage to the seed growing of potatoes. During June sowings (June 20), in the years 1937-1940, a premature

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wilting of the following varieties was observed on the individual farms of the territory: Early Rose, Lorkh and Woltman (from 8-46 percent) ... An identical situation was observed in summer plantings in the Crimea. Premature wilting of potatoes planted in the summer takes place in the Rostov oblast, as well as in other regions of the USSR.

Koroi wrote concerning the potato disease of summer plantings: " In 1939, in many regions of the Ordzhonikidze territory, mass disease of potatoes was observed with premature wilting of leaves, causing considerable loss to potatoes planted in the summer. This disease was noted in the succeeding years as well, though on a reduced scale. Its cause has not been established definitely... In the most severe cases the plantings are affected within several days by wilting 80-100 percent... The diseased plants either do not form any tubers at all or form one or two weak tubers..."

Our own observations and the data provided by Novikov and Koroi convince us that if periods of summer plantings of potatoes are advanced to July 10-15 there is a drastic reduction in the development of big bud. (See table 1, p. 74).

On the basis of these observations one would suppose that the planting of seed potatoes no earlier than July 10 would prove a radical means of controlling big bud. We drew this very conclusion in 1945. However, our observations of 1946 have complicated the problem.

On April 25, 1946 we planted the potato variety Lorkh at Krasnodar, obtained from the Krasnodar Vegetable Station. This potato had been propagated for five years by late July plantings exclusively (no earlier than July 8).

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It was natural to expect that there would not be much big bud on it. Nevertheless during the period of blooming, at a time when symptoms of big bud infection were lacking in that year, a mass infection of the tubers of these plantings (up to 42 percent) took place.

This experiment permits us to draw two suppositions. That in the course of the preceding five years there had been eruptions of belated big bud leading to a noticeable infection of July plantings, or that prior to the July planting the potatoes had already been considerably infected by big bud.

The question of the significance of July planting, as a radical means of controlling the disease, requires, therefore, futher experimental checking. During the corresponding tests an immaculately pure seed stock material has to be used.

The beneficial effect of July plantings upon potatoes grown from infected tubers has nevertheless already been established. While tuber-big bud of spring plantings reduces the yield and the commercial value of potatoes drastically, it produces only a relative lowering of the yield of July plantings. The characteristics of the variety appear distorted in July plantings as well; thus, for instance, in spite of their large size, tubers are greatly deformed, frequently misshapen, but their gross yield may reach 10 tons per hectare. This radically distinguishes the development of diseased plants of spring and summer plantings and clearly demonstrates the influence of ecological conditions upon the development of the diseased potato.

Observation of the tuber-big bud of spring planting showed that even in the early stages of the potato's development the virus remained in a latent state and barely accumulated in the tissues. Only in the blooming stage an increased reproduction of the virus took place, the tissues gained a noticeable

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degree of infection and external symptoms of the disease appeared simultaneously. Thus, in spite of the fact that the virus exists in the tubers from the very beginning, the development of the disease starts only after a long incubation period which terminates in the blooming stage. The incubation period of big bud depends in the strongest measure upon temperature. An experimental deliberate infection of the tomato made in early June produced external symptoms in 24-30 days, while during an infection made in the third week of July the incubation period of the disease was extended one and a half months and more.

The late development of potatoes of July planting and the longer incubation period of big bud of tuber origin cause potatoes planted in July not to show any external symptoms of the disease. The absence of symptoms or their very late development point to a latent condition of the virus and its weak reproduction capacity and activity. If the concentration of the virus is limited and its activity curtailed, the harm it will cause will naturally also be low. Plants grown from infected tubers planted in July show consequently a radical increase in yield.

It is true that this circumstance does not free the germinated tubers from the virus. Only the "depression" during the period of tuber formation is lacking. At subsequent spring planting the reproduction capacity and the activity of the big bud may prove high enough to cause severe infection and a strong reduction in potato yield. It is equally likely that a part of the July tubers may escape the infection since the virus is not present in large amounts in the tissues of the maternal plant and is unevenly distributed. The solution of this problem requires further special tests.

The above data shows that Lysenko's method, provided July plantings are kept up , represents a powerful means of increasing potato yields in southern regions that are distinguished by a wide spread of the disease. It is, nevertheless, essential to point out that this method is not sufficient to preserve all varietal qualities of the potato in cases where the tubers are infected by the virus. The solution of the problem concerning the protection of July plantings from big bud is an actual problem and demands special investigation. The elimination of big bud on late July summer plantings will result in a rise in the potato yield in the south. The situation is different with regard to varieties sensitive to crinkled mosaic. Observations show that such varieties as Early Rose, for instance, are subject to rapid degeneration when infected by mosaic, not alone in the south but also in the central oblasts, and not only in spring but also in summer plantings. The rapidity of the processes of degeneration varies in different latitudes. It is lower in the north, and higher in the south; in the central oblasts such varieties suffer greatly also from mosaic. In this connection the problem of selecting resistant varieties is important and should not be delayed. We still do not possess early varieties that are resistant to mosaic. They have yet to be produced.

It is also necessary to widen the work of selecting varieties resistant to big bud. Here we may point to the success achieved by the Scotch who already possess varieties of potatoes resistant to the virus of leaf roll which closely resembles that of big bud.

We ourselves possess such splendid varieties as Lorkh, resistant to mosaic. If on this basis new varieties would be produced, proving equally resistant to big bud, the problem of southern potato growing will be solved. Varieties of tomatoes have already been developed possessing relative resistance against big bug - these are the "shtambovie" tree tomatoes. The resistance of the tree varieties is so far not too high but they represent good initial material for the selector to start from. It is essential to determine the varietal reaction of the potato to the big bud virus and to segregate the most resistant forms.

At the Krasnodar Vegetable Station we observed the planting of the perennial wild potato - Solanum giberulosum. Plants of this species grew without change on this lot for three years and among them were observed only a few plants infected by big bud. Simultaneously, annuals growing at a comparatively close distance from them, i.e. tomatoes and peppers, were infected by beg bud 60-70 percent. It is possible that among the wildings there will be forms which when hybridized with cultivated potatoes will produce varieties resistant to big bud. The significance of genetic work with potatoes has to be propagandized.

Interesting experiments are produced at the Krasnodar Vegetable Station by M. K. Rubashevskaia. She is testing the hybrid Brigitta X Solanum boecense, of which two numbers (4-29, Kubanets and 19-51, Krasnodarets) represent ultra-early varieties. The potatoes of these varieties produce easily two yields in the south because the tubers collected early from the first harvest when planted in the soil grow well without any special cultivation. This offers the opportunity of planting these varieties in periods which escape the infection by big bud. For this purpose the first gathering of the crop is done in June and the second planting at the end of July. The methodical approach to the working out of measures of controlling the ecological degeneration of the potato and the virus diseases of this crop should vary.

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Unfavorable ecological conditions are overcome by summer planting in conformance with Lysenko's methods. To overcome the harmful influence of virus diseases on June plantings resistant varieties have to be produced. In this case additional methods may be used, specifically, chemical methods designed to destroy the vector. The utilization of effective insecticides against Haulesthes obsoletus may have great significance for annual Solanums which by the nature of their crop do not tolerate late plantings.

End of Article

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Uspenski, E.
In Selskokhoziaistvennaia entsiklopediia
[Agricultural Encyclopedia]. vol. 3
Moskva, 1934.

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Translated from the Russian by
S. N. Monson

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THE ORGANIZATION OF SCIENTIFIC-RESEARCH WORK

ON POTATO GROWING (p. 32)

Scientific-research work on potato growing in the USSR is conducted by the VNIIKH (All-Union Scientific-Research Institute of Potato Economy) and its network. The institute was founded in 1931 at the former Korenevo Potato Selection Station (village of Korenevo, Ukhtomski region, Moscow oblast).

Five zonal stations enter into this system of the Institute. They are - the Leningrad, Minsk, Voronezh, Ukrainian, and Central Volga stations. Each station serves its corresponding zone. The Moscow zone, the West and East Siberian zones, the Far East, (DVK), the Northern Caucasus, Trans-Caucasus and Central Asia are directly taken care of by the Institute.

The zonal stations in turn have their bases at state and collective farms which conduct practical work on potato growing in accordance with agricultural practices, and also take care of seed growing, seed testing, mechanization, control of disease and storing.

The principal problems concerning methods in scientific-research work are solved by the scientific council of the VNIIKH. Problems of planning and organization of work are subjected to consultations at the All-Union Potato Conference which is called once every two years. Skilled cadres of potato specialists are prepared by the VNIIKH ("aspirantura");personnel on the medium level is trained at special potato technicums, frequently located at the zonal stations of the VNIIKH. The lower cadres (approvers, examiners, seed growers) are given special courses arranged by the VNIIKH and at all zonal stations.

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End of article.

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Bibliography:

Afanasiev, I. Handbook on the application of fertilizers for potatoes. Moscow-Leningrad, 1933.

Veselovski, P. Potatoes. Leningrad, 1930.

Klapp, E. Potato Variety Growing. Moscow-Leningrad, 1933.

Rozhdestvenski, N. and Uspenski, E. Potatoes and their Storing. Moscow-Leningrad, 1931.

Sobachenkov, P. Storing Ensilage of Potatoes, Moscow-Leningrad, 1931.

Present Conditions of Potato Growing. Moscow-Leningrad, 1931.

Potato Approver's Companion. Moscow-Leningrad, 1931.

The Work of the VNIIKH, 1-4. Moscow, 1933.

Chernishova, O. How to protect Potatoes from Diseases. Moscow, 1932.

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R-6?

Uspenski, E.
In Selskokhoziaistvennaia entsiklopediia
[Agricultural Encyclopedia]. vol. 3
Moskva, 1934.

Translated in part by
S. N. Monson

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THE STORAGE OF POTATOES (p. 31-32)

The rational organization for storing potatoes is of great importance. According to data provided by the Gosplan, losses from storing potatoes represented 12 percent of the entire yield in the years 1929-1930. According to tests made by the VNIIKH, performed in 1931 and 1932, the natural loss in weight during storage amounted to 7-8 percent, while during the winter months it averaged 1 percent a month, increasing by spring to 2 percent.

Stored potatoes must be dry, healthy, sorted, not damaged by frost and without rough mechanical injuries. Healthy potatoes, if properly stored in warehouses in the fall, will not require any further sorting during the winter. Different varieties of potatoes show a different reaction to disease, and mixtures of varieties therefore keep worse than stored ~~uniform~~ identical varieties of potatoes. The largest percentage in loss is incurred from the tuber disease - water and dry rot. The freezing of potatoes during untimely harvesting or inadequate transportation aids the spread of disease.

The normal temperature of a warehouse should be kept at 1-3° without drastic fluctuation, in moist air - close to 85 percent. An adequately equipped incoming-outgoing ventilation system serves (aside from the heating, where it is necessary) as heat and moisture regulator in storage places, air being supplied from below and extracted from above. The bin should not be filled over 1.5 meters.

There are permanent and temporary potato warehouses. Among the first are special storage places, transit storehouses, large railroad storage facilities where the loading and unloading is done during the winter (illustration 13), basements, cellars, etc. To the second belong - mounds ("burtii"), holes, ditches, etc.

Permanent storehouses must be equipped with bins having a grate floor that rises above the ground. The walls between the bins must also have double grates. The most suitable size of a bin is that holding one carload. Prior to loading potatoes in bins, the storehouse is disinfected with sulfur, in the proportion of 20-40 g. of sulfur to 1 m^3 of the area of the storehouse; lime is also applied within. It is advisable to add to the lime some copper sulfate (1 part of copper sulfate to 20 of lime).

Mounds ("burty") may be above ground and deep. Their depth depends upon the level of ground waters. The usual width of a mound is 2 meters. The height of an above ground mound is 1 m. and of a deepened one, i.e. 0.5 m., should be 1-1/2 m. The length varies according to the need. Ventilation is by vertical and horizontal wooden pipes. The covering of a mound should protect the potatoes from freezing. In the Central zone of the USSR the covering consists of a layer of 50 cm of straw and 50 cm of earth (illustration 14). For the temporary storing of potatoes (2-3 months), one may widen the mound to 3-4 and over meters (if potato manufacturing plants are available). The temperature within the mound or hole is observed by dropping thermometers into the ventilating pipes. A rapid rise of temperature during the winter, of above 8°, points to the beginning of rot among potatoes. Mounds or holes have to be opened without delay in such cases and the potatoes transported into a cellar.

Considerable losses are experienced in the transportation of potatoes. The potato is a product not adapted to transportation, since it contains about 80 percent of water and easily spoils in transit. The loss of young potatoes in a transportation lasting 4-6 days may amount to 40-50 percent. According to data furnished by the MSPO for 1928-29, the losses in fall transportation amounted to 12-14 percent. It is therefore advisable to bring the potato areas as close as possible to the points of consumption and reduce railroad transportation to a minimum.

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End of article.

Kirakosian A. V., an Khachatrian, G.A. Transl. 165: Potatoes

Virus diseases of potatoes cultivated in Armenia.
Akad. Nauk Armianskoi SSR. Izv. Biol. i Sel'sk. nauk.
3:3330344. 1950. 20 Er4

Translated from the Russian by S.N. Monson.

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Considering the economic importance of potato production and its considerable impairment by virus diseases, a study of the spread of these diseases was undertaken by a survey of potato plantings in different regions of the republic. Surveys were made in three regions which differ in ecological conditions: Echmiadzinsk, Stepanavansk and Kirovakansk regions.

The results revealed a considerable spread of mild mosaic, necrotic mosaic, and diseases of yellows. Less prevalent were aucuba-mosaic and gothic. In addition to the above diseases, observations included necrosis of potato leaves and leaf roll of lower leaves affected by necrosis.

Studies showed that the spread of virus diseases in the above three regions differs. Diseases of yellows are more widely spread on low lands (Echmiadzinsk region) where the percentage of diseased plants amounted to 2.0 to 2.6, while in the mountainous region of Stepanavansk, it amounted to 0.4 to 1.3%. Wrinkled mosaic (necrotic) was found in low regions where damage amounted to 2.7%. Leaf roll of lower leaves with necrosis was also more frequent in low sections. Such diseases as mild mosaic (5% injury) and leaf necrosis (60%) have a wider spread in high mountainous regions of the republic.

In order to determine the relative impairment by virus diseases of the different varieties of potatoes tests were made at Erivan, on the former experimental plot of the Agricultural Institute, on the varieties Lorkh and No. 34, as well as on the Leninakansk experiment field of the same Institute, on the varieties Lorkh, Kalitinets, Woltman, Sevan, Phytophthora-Resistant, Narodny, Imrkhan, and No. 34. The results of these studies proved that the varieties Imrkhan, Lorkh, Woltman, Sevan are more affected by yellows. The percentage among the above varieties was 2 - 7. Wrinkled mosaic affected primarily: 34, Lorkh, Kalitinets, Woltman (3-7%). Mild mosaic was largely spread among the varieties Imkhran, Lorkh, Woltman, Narodny, and No. 34. Leaf roll with necrosis was noted at Erivan only on Lorkh. Leaf necrosis was particularly noted among the varieties Imkhran, Sevan and 34. The varieties are listed in the order of the/ir infectivity.

It is important/to stress that the potato variety Lorkh, substituted in Armenia for many local varieties, succumbs in some degree or other to all above listed virus diseases.

METHOD OF WORK

Experimental work on determi~~ng~~ning virus plant diseases was conducted in the following manner: 1. artificial inoculation of indicator plants; 2. planting of tubers of diseased plants in order to observe the course of the disease from year to year.

Young plants grown in vegetative vessels were artificially inoculated. Indicator-plants were: potatoes grown from seed, tomatoes, peppers and tobacco. Inoculation was by rubbing in the juice of diseased plants, as well as through the host-insect of virus diseases, the peach aphid. In inoculating with juice, the leaves were crushed in water in a porcelain mortar, previously sterilized for ten minutes, the surface of plants then carefully smeared with the extracted juice. Inoculation by insect was by feeding the peach aphid on diseased plants in small test tubes; into the latter young leaves of tested plants were placed for 2-3 days. Aphids thus transferred infection upon healthy plants.

Diseased tubers were gathered for planting from suburban zones of Echmiadzin and Leninakan and planted in the second and third year on the experimental field of the Agricultural Institute at Erivan. In addition to tests made during the summer, a record was kept on this plot the average tuber yield from one clump.

Plants of apparent health were also submitted to virus analysis; first, to act as control, secondly, to reveal the latent "X" virus in them.

Below are published the results of the analysis among healthy plants and those inoculated with various virus diseases.

TESTS MADE WITH HEALTHY POTATOES: Leaves of healthy potatoes of the variety Lorkh were taken from potato plantings of Erivan and Echmiadzine.

Table 1 presents the result of ~~the~~ analysis in artificial inoculation with juice of healthy plants. According to these figures, no infection was observed as a result of the test. But in inoculating with the juice of potatoes brought from Echmiadzin, symptoms of the disease appeared in the form of leaf necrosis and mosaic on potatoes, mosaic and ring spot on peppers, in addition to distortion. Control plants occasionally showed symptoms of the disease. This circumstance must evidently be ascribed to the fact that our tests were mostly conducted without isolators. When peppers diseased with ring spot were inoculated a second time, the plants exhibited again the same symptoms.

Inoculation of plants through the peach aphid showed that the disease is not transmitted by the insect.

Virus obtained from a healthy plant was tested for resistance to temperature and propagation to identify it. The juice of the diseased plant (pepper) was for this purpose submitted to a temperature of 60-70° for ten minutes and both peppers and tomatoes were inoculated; uninfected control plants were left.

Results revealed that the virus becomes inactive at 60%. Testing of virus at 0.01, 0.001 and 0.0001 dilutions showed that the virus becomes inactive at dilution of 0.0001. Studies of healthy potatoes lead to the assumption that the potatoes were infected by the latent "X" virus (Solanum virus 1 Orgon), (K.Smith classification), although the temperature obtained by us differed from the temperature of inactive "X" virus.

Table 1.

RESULT OF ARTIFICIAL INOCULATION OF HEALTHY PLANT WITH JUICE

Location where specimen was taken from	Infested plants	No. of plants	No. of infested plants	Symptoms of disease
	potatoes	4	0	None
	Control	2	0	
Erivan	Tomatoes	4	0	None
	Control	2	0	
	Peppers	4	0	None
	Control	2	0	
	Potatoes	3	3	Necrosis and Drying of lvs.; mosaic on one plant.
	Control			
	Control			None
Echmiadzin	Tomatoes	5	3	Necrosis of lvs.
	Control	2	2	Necrosis of lvs.
	Pepper	4	3	Mosaic, then ring spot with Necrosis and drying of leaves.
	Control	2	0	None

NECROTIC MOSAICS

WRINKLED MOSAIC.

Virus diseases are rather prevalent in different regions of the Armenian SSR. Typical symptoms of the disease are: mosaic, wrinkling of leaves, necrosis, first along veinlets of leaves, then along the entire leaf, drying of lower leaves in upward direction, bare stems, and in the majority of cases rapid death of the entire plant. Analysis of potato viruses were performed with specimens of potatoes No. 34 gathered from the plot of the Institute of Technical Crops at Echmiadzin. The result of this analysis of diseased potatoes bearing symptoms of wrinkled mosaic is submitted in table 2.

Table 2

RESULT OF ARTIFICIAL INOCULATION WITH JUICE OF DISEASED POTATOES (WRINKLED MOSAIC) and APHIDS

Inoculated Plants	JUICE Number of Plants	JUICE Number of infested Plants	JUICE Symptoms of Disease	APHIDS Number of Plants	APHIDS Number of infested Plants	APHIDS Symptoms of Disease
Potatoes	3	3	Mosaic, leaf necrosis, one plant dried soon	4	4	Necrosis of leaves and stems
Control	2	0	None	2	0	None
Peppers	3	3	Mosaic and leaf necrosis	2	2	Mosaic and leaf necrosis
Control	2	0	None	2	0	None
Glutinose	2	2	Mosaic on new lvs.	-	-	-
Control	1	0	None	-	-	-

This disease is also transmitted by juice and aphids. Repeated inoculation with the juice of diseased peppers gave the same results. Transmission of the disease by juice and aphids and the nature of external symptoms of the disease bring it close to necrotic mosaic, especially wrinkled mosaic, originating from potatoes infected with "Y" virus (Solanum virus 2 Orton, classification K. Smith).

In addition to tests of artificial inoculation, tubers of diseased potatoes were planted to study the degree of transmission of a disease by tubers from year to year. In the first year, i.e. the year of tuber gathering, the disease exhibited the symptoms described above. Results of tests on the development of wrinkled mosaic in potato No. 34 in the second year and the record of its yield per clump are presented in table 3.

Table 3

DEVELOPMENT OF SYMPTOMS OF WRINKLED MOSAIC AND POTATO YIELD

Location of gathering of potatoes	Symptoms of disease in first year	Symptoms in second year	No. of plants: Total	No. of plants: Producing yield	Average Yield per Clump: Number of Tubers	Average Yield per Clump: Weight in grs.	%
Erevan (tubers obtained from seeds	Healthy Plants	Healthy Plants	16	12	7	137	100
Leninakan	Mosaic, wrinkling ~~of lvs~~, necrosis, drying lvs; bare stems	Mosaic, wrinkling necrosis, dwarfness chlorosis, drying; bare clumps	53	39	4	34	25
Echmiadzin	Mosaic, wrinkling of lvs, necrosis, drying of lvs; bare stems	Mosaic wrinkling necrosis, dwarfness, chlorosis, drying, bare clumps	13	9	3	17	12.4

In both forms diseased plants die soon, reducing the yield considerably. Injury caused by the disease is more severe from tubers obtained at Echmiadzin than from those grown at Leninakan. In the third year the disease carried the ame symptoms but the plants dried out sooner and did not produce any yield at all. Thus, according to results obtained from our tests of artificial inoculation andplanting of diseased tubers, it may be assumed that this potato disease is typical of [redacted] wrinkled mosaic.

VIRUS LEAF ROLL

At the plot of the Institute of Technical Crops at Echmiadzin a clump of potatoes was discovered (1946) of the variety Lorkh, in appearance normal and green, but with rolled leaves, especially upper, and dense foliage. Artificial inoculation of plants with the juice of this potato (and aphids) revealed that the disease apparently belonged to necrotic mosaics. Results are presented in ta-le 4.

ARTIFICIAL INOCULATION WITH THE JUICE OF DISEASED POTATO(LEAF ROLL) AND APHIDS

Inoculated Plants	JUICE			PEACH APHID		
	Number of Plants	Number of Infestations	Symptoms of disease	Number of plants	Number of Enfestations	Symptoms of Disease
Potatoes	4	3	Leaf necrosis, one plant dried	5	5	leaf necrosis, 2 plants dried;
Control	2	2	leaf necrosis	2	2	leaf necrosis
Tomatoes	3	3	Necrosis of lvs.	5	4	leaf necrosis
Control	2	0	none	2	0	none
Pepper	4	4	Mosaic & leaf necrosis; later chlorosis & green spots on lvs.	4	0	None
Control	2	0	None	2	0	None

As will be seen from table 4, necrosis and mosaic appear as a result of artificial inoculation by juice and aphids. Repeated inoculation with juice was made on peppers and tomatoes, as a result of which necrosis, drying of lower leaves, mosaic and stunted growth were observed in peppers, and on tomatoes @ stem necrosis, drying of petioles and defoliation. According to its symptoms the disease may be regarded as necrotic mosaic. The potatoes were evidently infested by one of the "Y" viruses.

MOSAIC; NECROSIS, CHLOROSIS.

In addition to the above described diseases, we discovered several variations in diseases of potatoes. Although they undoubtedly belong to necrotic mosaics, their external symptoms are not alike. These diseases were not submitted to artificial inoculation. The external symptoms, however, transmittance in the second and third years, as well as the considerable loss in yield support the supposition. Tubers of diseased potatoes of the variety Lorkh were gathered chiefly at Echmiadzin from the plot of the Institute of Technical Crops and planted at Erivan. In table 5 the symptoms of disease are described as gathered in the first and second year; the average yield per clump is also indicated.

Table 5

SYMPTOMS OF DISEASES ON PLANTS OBTAIN IN PLANTING TUBERS FROM DISEASED PLANTS"

Symptoms of Disease	Disease in 2nd year	Total	Producing yield	Number of tubers	Weight in grs.	°/.
Healthy	Mosaic and necrosis on some plants	15	11	6	84	100
Dwarfness Small lvs. Light chlorosis, necrosis	Dwarfness, mosaic, deformed & dense foliage leaf roll	5	3	5	52	62
Dwarfness, mosaic chlorosis, necrosis along veinlets	Dwarfness, chlorotic, dense, small deformed lvs.; mosaic necrosis	4	2	4	61	72
Mosaic, light wrinkling, necrosis of lower lvs.	Dwarfness, mosaic, chlorosis, necrosis	9	6	2	12	11
Mosaic and necrosis	Dwarfness, leathery lvs.	10	4	3	17	20

According to table 5, the first two diseases resemble each other in their external symptoms (dwarfness, deformation, leaf roll, and almost identical reduction in yield). Leaf roll and deformed foliage appear in the second year. Artificial inoculation of healthy potatoes and tomatoes by the peach aphid revealed that this disease is transmitted by insects and appears on potatoes in the form of mosaic, on tomatoes as leaf roll and deformed leaves.

Results of experiments on the following two diseases having symptoms of mosaic and necrosis indicate rather severe injury and loss in yield (80°/.). In artificial inoculation of Nicotiana glutinosa (bean) with the juice of a diseased plant, affected by mosaic and light wrinkling of leaves, the glutinose produced mosaic with severe necrosis of lower leaves, beginning with the upper leaves, which led to rapid death of the plant. Similar symptoms were observed on inoculated tomatoes. The tubers of the above diseased plants, planted in the third year, produced plants with the same symptoms but no yield. The study of four diseases of potatoes, indicated in table 5, leads to the belief that they are all the result of infection by different genera (Stämme) of the "Y" virus, transmitted by juice and aphids, which reduce yields considerably. In necrotic mosaics of diseased potatoes, "X" virus was apparently present, in addition to "Y" virus. Combined action of the two viruses strengthens the disease.

DISE SES OF THE TYPE OF YELLOWS*

LEAF ROLL OF POTATOES* In the Echmiadzin region and famrs of Leninakan and Erivan a disease is frequently met resembling leaf roll. According to authoritative data (1) the disease in the second year shows symptoms of leathery leaves, delicate and generally chlorotic, occasionally becoming reddish and violet colored because of the presence of anthocyanin in them. Leaf lobes roll around the central vein, infection spreads upwards. The disease is not transmitted by juice but by aphids and grafting.

Leaf roll of potatoes is recognized in literature as one of the most serious diseases. The disease discovered by us resembles the above described disease, i.e. potato leaf roll.

In our test of artificial inoculations with the juice of diseased potatoes negative results were obtained. Potato tubers from plants diseased with leaf roll were planted on the plot of the Experimental orchard of the Agricultural Institute at Erivan. Seed stock was obtained from Echmiadzin for this p urpose.

Data on the development of the disease in the second year and the average yield from one clump are presented in table 6.

Percentage of ,lants which produced yields and the volume of the latter were very low, testifying to the severity of this disease. In the third year diseased tubers did not produce yield at all. The typical symptoms of disease and degree of injury make it evident that the above disease is potato leaf roll.

LEAF ROLL OF LOWER LEAVES OF POTATOES*

We stated in the beginning that in some regions in Armenia (Particularly lowlands), potato leaf roll of lower leaves is rather frequent along the principal vein and that considerable spread of necrosis prevails on foliage. Tests in artificial inoculation of a diseased plant with juice brought negative results.

Planting of potato tubers, however, obtained from diseased plants, revealed that the disease is strengthened in the second year and reduces the yield, as show in table 7.

Table 6

INFLUENCE OF LEAF ROLL UPON POTATO HARVEST

Nos.	Symptoms of diseases	Disease in 2nd Year	Quantity of Plants		Average yield per Clump		
			Total	Producing yield	No. of tubers	Weight in grs.	%
1	Healthy	Mosaic, necrosis on some plants	15	11	6	84	100
2	Leaf roll, chlorosis, dwarfness, leathery texture	dwarfness chlorosis, leaf curl, undersized; mosaic	9	3	2	4	5
3	Leaf roll, chlorosis, necrosis	Chlorosis, lf. curl, pink anthocyanin on upper lvs.	8	2	7	40	48

Table 7

INFLUENCE OF LEAF ROLL UPON POTATO YIELD

Symptoms of disease	Disease in 2nd Year	Quantity of Plants		Average yield per Clump		
		Total	Producing yield	No. of tubers	Weight in grs.	%
Healthy	mosaic and necrosis of some plants	15	11	6	84	100
Leaf roll of lower lvs. necrosis	dwarfness, chlorosis, lf. curl, necrosis	5	3	5	56	66

As seen above, the yield from plants affected by leaf roll is relatively small compared to the control In the second year the disease exhibits other symptoms. Closer study is required for the final determination of the virus and infective nature of the disease.

POTATO WILT In the past few years a potato disease became widespread in Armenia characterized by wilt, yellowing of entire plant, and drying, beginning with lower leaves. Tubers of diseased plants appeared stunted. This disease causes large losses in yield.

In order to determine its nature, a test was made by inoculating with juice wilted and healthy potato plants, specimens of which were brought from Leninakan. Pepper and tomato seedlings served as indicator plants. The test did not succeed in showing the infectious nature of wilt. But it testified oncemore to the presence of the latent "X" virus in potatoes because of the appearance of ring spot, leaf, stem and petiole necrosis, in places stunted growth on peppers, and on tomatoes, leaf and petiole necrosis in slight degree. Studies made by K. S. Sukhov and A. M. Vovka (4,5,6) established, however, that potato wilt is of an infective "stolbur" nature, transmitted to healthy plants by certain species of cicades and grafting. On the basis of data furnished by these authors, we began tests of grafting under Erivan conditions. Graftings were made with petioles of wilted and about to wilt potato plants on healthy plants. The inoculated potato exhibited symptoms of wilt, as seen on ill. 1.

On an inoculated (by grafting) tomato the disease produced symptoms typical of stolbur. (ill. 2) Thus studyof wilted and dried potatoes in Erivan seems to confirm the stolbur nature of the disease, although additional experiments are required for final conclusions.

CONCLUSIONS

A Survey of potato plantings and study of virus diseases in Armenia resulted in the following conclusions:

1. In different surveyed regions virus diseases of the type of mild mosaic, necrotic mosaics, yellows, aucuba-mosaic, gothic, etc. are spread among potatoes.

2. Tests with artificial inoculation and planting of diseased tubers revealed the identity of wrinkled mosaic prevalent in Armenia with the ~~same~~ disease described in literature. Many diseases were identified ~~besides~~, which in their external symptoms differ slightly between themselves but apparently belong to the type of necrotic mosaics and are the result of infection of potatoes by various "Y" viruses.

3. Virus analysis of apparently healthy potato plants testifies to the infectivity of healthy potatoes by "X" virus.

4. Yellows were established as leaf roll of potatoes, appearing with typical symptoms of the latter disease, as described in literature. Planting of diseased tubers revealed that this disease is transmitted from year to year and severely reduces potato yields, occasionally causing its loss.

5. Leaf roll of lower leaves of potatoes with necrosis is apparently also a disease transmitted through tubers, although for confirmation of this statement additional, detailed study is required.

6. Potato wilt distributed in many regions of Armenia is not transmitted by the juice of a diseased plant. Grafting of wilted and dried out potato plants, discovered in Erivan, established nevertheless, their infective nature which resembles "big Bud" of tomatoes.

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Bibliography: V. L. Ryzhkov - Virus diseases of plants, 1935

V. L. Ryzhkov - Principles of theory on virus diseases of plants, 1944

V. L. Ryzhkov - Phytopathogenic viruses, 1946

K. S. Sukhov - et. al. Big Bud of Solanaceae, 1946

A. M. Vovk - Stolbur of potatoes, 1946

A. M. Vovk - Virus of Stolbur, 1947

KHOLODNYI, N.G.K.A. Timiriazev i sovremennye predstavleniia o fitogormonakh, [K.A. Timiriazev and modern ideas on phytohormones] Moskva, 1946, 34 p. 464.36 K52K

Transl. 106: Growth Substances.

Translated from the Russian by ~~SxxNxxMxxxxxx~~ R. Dembo.

The study of phytohormones is one of the youngest branches of contemporary plant physiology. Twenty six years ago, the year of K.A. Timiriazev's death, it experienced the last stages of the original collection of experimental data. Based upon these data, a conception soon aroused of "chemical regulators" in plant growth and development and a basic similarity has been discovered, from physiological point of view, between these substances and the hormones of animals. The most significant works in this field which served as the starting point for further close studies on plant endocrinology are the works of DZH. Leb, G. Gaberlandt, A. Paal' and others. They belong to the period of 1917-1921, i.e., to the last years of Timiriazev's life, when news concerning the newest achievements of West European and American science scarcely reached our country which has been cut off by a blockade from abroad. Therefore, it is not surprising that in K.A. Timiriazev's works we do hot find any references to these first achievements of the new branch in phytophysiology.

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But the scientific ideas, especially ideas on a large scale, which influence considerably the development of any branch of science, never originate spontaneously. Each of them has its own more or less complicated and long "Prehistory", the period of accumulating factual material and individual conclusions which are the necessary premises for the conception and development of the new thought. The idea of hormonal regulation of living phenomena of the plant organism also went through such "prehistory". Long before its final and quite well-grounded formulation, various assumptions, more or less probable, were expressed. These assumptions indicate the fact that the scientific thought under the pressure of facts by whimsical curves, but consistently, makes its way towards this new idea, vaguely trying to guess its ability of unifying, elucidating and enriching the vast domain of various experimental data.

The beginning of this preliminary opoch could be attributed to the end of the eighties of last century, when J. Sachs (1887) and M. Beierink (1888) almost simultaneously and independently from each other expressed the thought of the presence in plants of physiologically active substances with a regular function. M. Beierink arrived close to the conception of phytohormones in their present meaning. Proceeding from his studies on the development of "tsesidii" (gall) which originate in plants under the influence of cynipoids and other gall forming insects, Beierink arrives at the conclusion that even in a normal morphogenesis of a vegetating organism some specific substances should play an essential role - "growing enzymes", according to his terminology - which are the product of life activity of the protoplasm of the plant itself.

It is necessary to note, that analogical thoughts, and considerably earlier, originated, possibly, from Ch. Darwin who attached great significance to the chemical substances in plants as one of the factors of their normal and pathological morphogenesis. It is interesting to note that Darwin also arrived at these thoughts by his observations with galls. He also planned experiments (but, unfortunately, he did not realize them) on the artificial obtaining of these formations in order to start this way the experimental study of irregularity law. In referring to these thoughts of Ch. Darwin, K. A. Timiriazev indicates (Works, volume VII, page 562) that they manifest the "outstanding perspicacity" of the great biologist.

This remark of Timiriazev points out that K. A. referred favorably to the first attempts of the experimental study of the influence of various chemical agents, including substances produced by the plant itself, upon the formation of vegetative organisms. It also might serve as an example for those numerous and always interesting ideas in which Timiriazev gave a critical evaluation to various directions of scientific thought and individual studies which prepared the foundation for the development of the study of phytohormones. The analysis of these ideas against the background of the contemporary stage of our knowledge about hormonal substances in the plant organism is of great interest for the history of science, and is the basic problem of Timiriazev's interpretation.

It is necessary to keep in mind that K. A. himself did not work experimentally neither on the problems which are directly connected with the problem of phytohormones, nor even on those problems which were preparing the ground for their formulation. The absence of his own experiment could not, of course, be replaced by any experiment of somebody else, and this circumstance, as we shall soon notice, influenced many conceptions of Timiriazev in this domain. Some of them are, undoubtedly, mistaken; others require corrections. But all of them reflect in some way the peculiarities of his brilliant analytical mind, his passionate, violent temperament, his intolerant adherence to principles when it comes to defending the basic conceptions of that scientific, strictly materialistic and Darwinistic ideas which he gradually developed in all his works. That is why even the mistaken interpretations of this greatest scientist-thinker often manifested positive influence upon the development of our science, drawing to it new young scientists and encouraging them to concentrate their attention upon those problems which K.A. himself was unable to solve, because they were not a part of the basic stream of his own experimental studies.

II

The last decade of the nineteenth century and the first decade of the twentieth century were marked by a speedy and fertile development of endocrinology of animals and of man. K.A. Timiriazev who followed during his entire life-time the progress of scientific thought and the widening of our knowledge in all branches of Biology could not, of course, ignore such an important achievement, as the study of inner secretion and of the physiological significance of hormones as the regulators of life phenomena of the organism. In articles which summed up the latest achievements of science he often dwelt upon the most important facts from this domain and expressed some ideas, for instance, concerning the role which the endocrine glands were able to play in the evolution of organisms (Works, vol. VII. p. 462-465 and others).

As a follower of Darwin, K. A., of course, shared Darwin's conviction in the unity of the organic world, in the absence of principal quantitative differences between animal and plant organisms. This is indicated in his chapter before last, called "Plant and Animal", in "The Life of Plants". Here Timiriazev, after having analyzed the basic functions of typical representatives of both domains of organized nature arrives at the conclusion that "the difference between plants and animals is not qualitative, but quantitative; in both the same processes occur, but in one domain predominates one type of processes, and in the other - another type of processes" (Works, v. IV, p. 296).

It was natural to spread this conclusion over the activity of the just discovered, physiologically active, hormonal substances. If they are the permanent part of every living organism, if almost every process in them depends, in some degree, on some chemical regulators - the products of secretive activity of cells and of tissues of the very organism, then the question arises: Would it not be possible to find similar phenomena in the domain of plants, do not plants possess substances which are similar according to their genesis and to the activity, to the hormones of the animal organism?

There is no doubt that K. A. did discuss this problem and that he gave an affirmative answer. We arrive at this conclusion based especially on one passage in his lecture "The Historical Method in Biology" (Works, v. VI, p. 174). Discussing the problem of the effect of the "reproductive property" - male sexual cells - upon the maternal organism and pointing out the causes of origin of so-called xenyl, whose nature became clear only after S.G. Navashin discovered a double fertilization (the fusion of one male testicle with the testicle of the egg cell, and the other with the testicle of the embryonic pocket. K. A. writes: "Still less clear are the influences of the reproducive property upon the more remote parts of the maternal plant. Some scientists even reject them, but they have no reason for it, taking into consideration all the experiments (for instance those of Gil'debrand), especially since the discovery of hormones - substances which develop in organisms and which cause organic changes from a distance.

This remark of K.A. Timiriazev is worth consideration from two points of view. First, it indicates clearly that K.A. considered the possibility of the existence of hormones in the plant organism. Second, it once again indicates the scientific perspicacity of K.A. In this case he somehow guessed the origin and development of one of the most interesting branches of the contemporary study of phytohormones. At the present time there exist a series of works which indicate, that in floral plants during the pollination a certain amount of hormones enter into the maternal organism. These hormones are formed by pollens and pollen pipes, i.e., by formations which belong to the paternal organism and that these substances influence considerably the growth and development of several tissues and organs of the maternal plant.

G. Fitting, studying post-floral changes (which follow pollination) in the flowers of orchids, indicated in 1909-1910, that some of these transformations are determined by the effect of the active substance which exists in pollens and which is also produced by pollen pipes during its growth. Here belong, for instance, the postfloral growth of the ovary and stigma and the thickening of the gynoval ("ginostemii") i.e., the organ which was formed in the orchid by means of fusion of the core with the stamen filament. This same factor affects the transformation of the coloring of pericarp and, in many cases, the life cycle. It is quite possible that all these phenomena are explained by the formation of auximone - the most spread phytohormone in the vegetative world - from pollen and from pollen pipes.

Later on, various authors discovered the presence of an active substance of the auxinone type in the pollen of most varied plants.

It is true, in all described cases until now, the source for phytohormone is, apparently, not "the reproductive property" in the strict meaning of this word, i.e., not the male sexual cell. But is it quite possible that even the latter introduces into the egg cell and into the surrounding tissues of the maternal organism physiologically active solutions which are able to influence their growth, development and exchange of substances. The problem of future studies - is to examine more thoroughly all these phenomena and to elucidate their role in the preesses connected with reproduction. The physiology of reproduction is a domain which has not yet been studied by our contemporary phytophysiologists. Here they are faced with a tremendous and most important task. The thought expressed by K.A. Timiriazev concerning the production by the male sexual cells of hormonal substances capable of influencing not only the egg cell, but also the cell elements of the maternal plant which surround it, will at the beginning, be the guiding point for this work.

III

In the development of contemporary study about phytohormones a very important role was played by the explorations consigned to orienting motions - tropisms - of higher plants. The start for these studies was made by Darwin's work, "The plant's ability to move", which was published in 1880. This was the last important research of the great biologist. It considerably influenced further development in the physiology of motion and growth of the vegetating organism. But its significance has been underestimated or wrongly evaluated for a long time. We should dwell more circumstantially upon the causes for this circumstance, in order to elucidate the ideas and critical remarks made by K. A. Timiriazev, in regard to this work.

The Biology of the second half of the nineteenth century has been developing during the victory of a new conception of nature, the historical and mechanical. The historical principle was introduced mainly by the works of Ch. Darwin, the mechanical conception reached much further, based upon the achievements, ~~xikk hixxaxxixianmax~~ in other branches of natural sciences, especially in physics and also in some branches of physiology, with his assistance. These basic features in the development of biology during the indicated epoch were many times referred to by K.A. Timiriazev.

The role and the significance of the two mentioned principles in the science of nineteenth century were, however, not similar. The historical method, which has been so brilliantly displayed in the genial works of Darwin and which acquired immediately a wide recognition, was nevertheless a comparatively new, slightly tested instrument in understanding nature, and its further expansion often encountered on its road serious obstacles in the conservatism of biological thought. On the other hand, the mechanical principle which had in the past considerable merits as the source of guiding ideas in its research of the most variable phenomena of inorganic, and partly organic nature, disclosed an obvious tendency towards the penetration into such domains of natural sciences where its rights were quite disputable. And while the historical direction in the Biology of the nineteenth century was a factor which was progressive in every repect, the mechanical approach began to play a somewhat reactionary role as long as it checked the further development of this science and deviated it into the wrong direction.

Thus was the role of the mechanical principle at the end of the nineteenth century in the explanation of plant physiology to which Darwin consigned his last work. The predominating conceptions in respect to the motion of plants did not excel the frames of purely mechanical schemes. The dislocation of parts and of organs of higher plants caused by the effects of light, heat, weight and of other external factors was explained by the changes in growth and the tension of tissues in the place of direct effect of these factors - based upon some physical laws. The thought of the explorers in this line did not go further than the primitive, mechanical conceptions and did not consider the facts which indicated a more complex character of phenomena which occurred in the vegetating organism. There was no serious attempts to understand the nature of the strange "regularity" of the observed motions, to give it some kind of a scientific explanation.

Darwin approached the study of motion of the vegetative organism from an entirely new point of view. For him, in this domain, as well as in all others pertaining to his special explorations, the leading point were two basic ideas of his evolutionary study, namely: the idea of the natural genesis - based on selection - of all manifestations of the adaptation of organisms to the environment and the idea of genetic relation between all the representatives of the animal and vegetative world. These relations are caused by the common conditions of their origin and are basically similar in their structure and physiological processes. These two ideas fully determined the general direction of Darwin's work in regard to the mobile capacity of plants. On one hand, Darwin tried to explain the ways of evolution of this capacity starting with its simplest manifestations common to all vegetative organisms and ending up with the most specialized manifestations which carry in them all the signs of adaptation reactions. On the other hand, Darwin aimed to prove, by means of physiological analysis of the most varied movements of vegetative organisms, that in some cases these movements, in their complexity, are not inferior to the movements of lower animals and, consequently, could not be placed into the frames of those simple, mechanical schemes which satisfied Darwin's predecessors and contemporaries - specialists on plant physiology.

These two problems were successfully solved by Darwin: the first - by means of genetic correlation between all the forms of motions with its complexity whose wide spreading in the vegetative world has been determined by Darwin himself; the second - with the assistance of a series of fine experimental surveys which disclosed the space differentiation of the sensitory and the motor functions in various organs of many plants. Finally, a deep ecological analysis enabled Darwin to elucidate in his work, as in his other research, the winding and climbing plants, the certain adaptability of many motor reactions in many higher plants under observation; and based upon this, to give a satisfactory explanation of their regularity, so miraculous at the first glance.

The work of Darwin, in its general direction and in its specific conclusions, differ from the established opinions of the majority of botanists, - physiologists of the nineteenth century. Therefore it has been received unfriendly. The head of the German school of phyto-physiologists, IU. Sachs in his "Lectures on Plant Physiology", published in the year of Darwin's death (1882), in explaining why he never mentions the works of Darwin on plant movements, writes: "I am sorry that the name of Charles Darwin is written at the title. The experiments which he describes are carried out without competence and are poorly explained, and the good which is slightly mentioned in the book, is not new". Sachs also gave a negative criticism to the orienting motion in the circled nutation.

Sachs limited himself to the open criticism of Darwin's work without trying to explain to the reader how he explains the mistakes of the author. Another great German physiologist - IU. Vizner - appeared already in 1881 with a more circumstantial criticism which he tried to verify by his own experiments. Unlike Sachs, Vizner does not hide the ideological motives of his attitude to the criticized work. For "sound natural science", according to his opinion, the natural scientific explanation should coincide with the "mechanical", and many puzzling phenomena in the movement of vegetative organisms could be summed up to simple mechanical processes.

What was Timiriazev's attitude to Darwins research on plant movement? A basic purely evolutionary position of these explorations stimulated in him a vital admiration and approval. He discusses it circumstantially in the last chapter of his book "Ch. Darwin and his teachings". K.A. gives a positive evaluation of Darwin's idea on the origin of various types of motion from the circle nutation. According to his opinion, the question arises, whether the circle nutation could be considered as an autonomous phenomenon (thus was Darwin's point of view) or it is based upon the effect of a sum of exterior factors. K.A. writes further that "Darwin's unquestionable great merit is that he discovered many phenomena which were not even suspected before". Which are the discoveries of Darwin to which Timiriazev is referring, we shall learn from his other book - "The Life of Plants" where we read the following (Works, v. IV, p. 212): "The ideas of botanists concerning the correlation between the growth of the organs and external influences should become more complex after the outstanding, most original explorations of Darwin. He proved that the place of the effect of the external stimulator and the place where this effect is manifested may not coincide some time". Further, he discusses Darwin's experiments with beheaded roots which cease to react upon the effect of gravity and with the sprouts of grain which, after the darkening of the tops of their coleoptiles (feathers), loose their capacity of turning towards light".

Thus, the entire content of Darwin's work concerning the plant movement, including those divisions which were rejected by German physiologists, has been highly evaluated by K. A. Timiriazev. Nevertheless, this unconditional approval was mixed with the feeling of bitterness in regard to one unsuccessful thought of Darwin or, as it would be more correct to put it,- Darwin's tendency of underlining all those peculiarities of plant movements which indicate the impossibility of a simple, mechanized explanation, and which at the same time enables us to compare the motor reactions of the vegetative and animal organisms.

Where are the roots for this bitter feeling or dissatisfaction which darkened the sincere admiration which K.A. had for Darwin's work concerning the motor capacity of plants? We may indicate two sources which nourished this feeling.

In "The Life of Plants", directly close to the passage which we just quoted, in which Timiriazev evaluates highly the "brilliant and original" experiments of Darwin with the roots and coleoptiles of grains, the author writes the following (Works, v. IV, page 213): "These factors were sufficient to assume at the edge of the root, of the grain feather, the existence of some special sensitory organs which transmit to the plant their impressions and cause their deformation."

Thus, according to Timiriazev's opinion, these experiments of Darwin with the roots and coleoptiles served as the guiding point for that direction in plant physiology which at the beginning of the twentieth century reached its highest development, especially in Germany, where it was named "the physiology of stimulus" (Reizphysiologie). In the foreword to the English edition of "The Life of Plants" (1912) K. A. Timiriazev, speaking of "this contemporary flood, quite dangerous", of this new direction, indicates that it is accompanied by "diseased tubers in the form of neovitalism and phytopsychology with its natural result - anti-Darwinism" (Works, v. IV. p. 43).

We cannot deny that the new factors which were determined by Darwin were widely utilized by the idealistically minded followers of the physiology of irritability and "phytopsychologists" for the confirmation of their vitalistic and anti-Darwinistic conclusions. Then the question arises: is it possible to make Darwin responsible for these conclusions? K. A. Timiriazev assumed, undoubtedly, that Darwin is partly responsible for this fault of the origin of this unhealthy direction of the phytozoological thought. He expresses this thought in his article "The year of sum up and of anniversaries (from scientific chronicles of 1909)". Here, mentioning the fact that the hypothesis of pangenesis discussed by Darwin is starting to be outmoded, Timiriazev writes (Works, v.IX, p. 112): "Unfortunately, this can not be told about his final words in his last work": 'The motor ability of plants', which he would reject himself as he did reject his pangenesis. They had a bad influence upon many botanists including his son and co-worker on this research - Francis".

"In these words, - continues Timiriazev, - Darwin expressed the wrong thought that the root edge in a plant could be compared to the brain, because by removing it, certain deformations do not occur or do not occur drastically. This metaphore (which does not find any analogy in the animal organism) was contradictory to that basic idea of Darwin which encouraged him to concentrate his entire scientific activity upon plants, since in them he was able to point out the existence of selectivity without the presence of conscience". This "unhappy metaphore", writes K. A. further, appealed to the German botanists. "A series of German botanists tried to develop the thought of Darwin concerning the root conscience (underlined by N. KH.); from here originated the study of sensitory organs in plants and, finally, of its soul".

A little bit further (page 114) K. A. again returns to this question: "botanists, - he writes, - without any reason, try to find instead of the strictly experimental method, some psychological parallels, absolutely unfounded, empty guesses on "memory" as the basic property of the organized substance, the capacity of the plant to "study" and to act accordingly with the acquired knowledge, on the growth of some organs from the "root brain"; such example is not even mentioned with animals".

Thus, according to K. A. Timiriazev, the work of Darwin concerning the motor capacity of plants, not only contained factual material, later utilized by the phytopsychologists for their purposes, but also gave them an ideological support in the form of "a thought on the root conscience", which, of course, could easily be developed as the thought on plant's soul.

In summing up all the ideas of K. A. Timiriazev, concerning Darwin's work on plants' motor capacity, we see that K.A.,while considering the great scientific value of the experimental data and basic conclusions of this work, insisted at the same time upon the fact that this theory is based upon a mistaken thought which was the guiding point for the development of phytopsychology.

Then the question arises, how well founded is this "accusation" against Darwin by his convinced follower. A close study of Darwin's work concerning the motor ability of plants leads us to conclusion that this accusation is based upon a misunderstanding and that there are no bases to consider Darwin being responsible for the mistakes of the phytopsychologists.

Really, let us analyze the final words in Darwin's book which, according to Timiriazev's opinion, "had such a harmful influence upon many botanists" and served as the guiding point for the development of the teaching of the soul of plants. Here it is: "It is hardly an exaggeration to say that the root edge which has the ability of directing the motions of the neighboring parts acts like the brain of the lower animals which is located in the front of the body which perceives the impressions from sensitory organs and which direct various motions".

We see that not a word is here mentioned about the "root conscience". But, may be, this thought was expressed by Darwin in some other part of his extensive works? But our search would be in vain: nowhere and never did Darwin insist upon the thought that the root or some other part of the plant possesses "conscience." It is hardly possible to read that thought "between the lines" in the concluding words of his book. Studying them quietly and objectively, without any prejudice, we will not find there anything, except the intention to prove that the movement of plants according to their peculiarity of interior "mechanism", according to the degree of differentiation and complexity of physiological phenomena connected with them are not inferior to the motions of many lower animals that possess a central nervous system in the form of a primitive brain. Such intention is quite natural, if we recall that, according to Darwin's words (see his autobiography and the letter to A. DeCandolle of May 28, 1880) he always enjoyed "lifting the plant to a higher level of the organic ladder". Each new fact which indicates such a possibility, according to Darwin, proves the consanguinity of all living organisms, the basic similarity in their construction, the unity of roots of the entire organized nature and, therefore, should assist in the victory of Darwin's basic principles.

How did it happen that such an excellent student of Darwin's works, as Timiriazev, who understood better than any other scientist the spirit and the essence of Darwin's teachings, made such a mistake by attributing to Darwin - in a problem of greatest importance - a thought which the great teacher never even expressed?

In order to reply to this question, we must remember that the remark concerning Darwin's "wrong thought", by which he attributed conscience to plants, was expressed by Timiriazev at the pick of his argument against anti-Darwinists, neo-vitalists and phytopsychologists who often borrowed ideas from Darwin's book for the benefit of their mistaken opinions. Darwin's "unlucky metaphore", as Timiriazev calls it, - the comparison of the root edge with the brain of lower animals - was for them a real find: The brain is considered the organ of phychological activity! This seemed so convincing that Timiriazev himself shared the point of view of his adversaries. Meanwhile, as we shall see, he could easily disarm them by referring to another of Darwin's remarks. This remark has direct relation to those experiments with roots and coleoptiles, and proves irrefutably that the thought of the great biologist was directed not towards the attempts of explaining the movements of vegetative organs of the psychological plant activity, but towards the purely materialistic ideas which later on received excellent confirmation in the works of a series of authors who continued this research of Darwin already during our life time - in the twenties and thirties of this century.

Let us see, what was Darwin's real point of view. His experiments with roots and with coleoptiles of cereals proved clearly that from the tops of these organs "some kind of influence" is transferred into the zone of its growth. This influence causes the organ to turn into some direction during the effect of various external factors. What is the nature of this influence? If Darwin would turn to the trend of thought of phytopsychologists, he would pay attention to analogies with the reflex of the nervous stimulation in animal organisms and, maybe, to even more risky comparisons with the simplest psychophysiological processes. We don't find in Darwin anything of this kind. In discussing the more pronounced facts of the reflex of the "influence" - in sprouts of canary seed -

Phalaris canariensis - Darwin indicates that "these results, obviously, cause us to assume the presence of some substance in the upper part (coleoptiles), upon which light affects and which transfers its effect into the lower part".

Note: Ch. Darwin. The Power of Movement in Plants, 1880, p. 486 (London).

Thus we see that the miraculous influence of the upper part of coleoptiles which is sensitive to light upon the lower zone of the growth of the same organ, according to Darwin, could be explained quite simply - by the spreading from the top of some substance. This brilliant guess found its confirmation in a series of experimental research after forty years. It became evident that the coleoptile edge secretes phytohormone - auxin, and its distribution in the vegetative tissues affects the motor reaction - the bending of the organ into some direction. This discovery gave a mighty impetus in the development of the entire contemporary phytoendocrinology.

Darwin expressed his assumption only in applying to the coleoptile Phalaris. But is it possible to doubt that for other organs which he examined, including roots, he would look for another explanation? The movements of all these organs represent a full analogy with the movement which is observed in Phalaris sprouts.

It is evident that it is possible to ascribe to Darwin the tendency to phytopsychological thoughts only by ignoring (conscientiously and unconsciently) his real points of view, strictly materialistic which found its expression in the remark concerning the substance which regulates the effect of external factors from one part of the plant into another.

We could hardly suspect Timiriazev in a conscious distortion of Darwin's real points of view. Timiriazev simply did not notice the thought of Darwin, so occasionally mentioned, concerning the phenomena which occur in the coleoptile during the phototropical stimulus. Any new thought has the necessary effect only in that case if the ground has been prepared for its correct understanding.

There was no such ground for the understanding and further development of Darwin's idea during his life time nor during the succeeding decades. This is verified by the fact that even those explorers who repeated Darwin's experiments (Vizner, Rotert, Fitting and others) did not pay any attention to his brilliant thought. It did not correspond to the "spirit of the time"; the end of the XIX and the beginning of the XX centuries were the periods of flourishing of the idealistic physiology of stimulus. The representatives of this flourishing of the idealistic physiology of stimulus. The representatives of this direction naturally sought and found in Darwin's work only the item which was contributing to the development of their points of view. The "metaphore of the root brain" was helpful in their requirement and did not contribute at all to the materialistic idea concerning the substance which support the physiological connection between various parts of the plants.

Nevertheless, neither the followers of the ideological physiology of stimulus which tried to explain the motor reaction of plants based upon the date of nerve physiology of animals, nor the phytopsychologists were able to utilize Darwin's "metaphore" in order to strengthen their teachings. It soon became known that some parts of the central nervous system of animals have the functions of endocrine glands. The brain appendix, or hypophyte, of vertebrates produces a hormone which regulates the growth of animals and, consequently, according to its physiological significance represents some remote analogy with the root edge or with the coleoptile tip of cereals. Thus, Timiriazev's argument which indicates that in the animal world we do not know any examples of brain effect upon the growth of an organism.

Referring to the problem of Timiriazev's dissatisfaction to Darwin's work concerning the movement of plants we may say here that this feeling was nourished by the incorrect idea on the significance of Darwin's few experiments and conclusions in the domain of plant physiology.

Another reason for Timiriazev's duality towards Darwin's experiments over the movements of plants is closely connected with that peculiarity of Timiriazev's scientific points of view. As the typical son of the nineteenth century which Timiriazev, along with Bol'tsman, called the century of Darwinism and of mechanical understanding of nature, Timiriazev himself was inclined to overestimate the significance of the latter, the mechanical principle in the development of biology and especially of plant physiology. This characteristic of K. A. scientific individuality explains to us that preference which he always gave to physiological processes, at the expense of chemical methods and models. In his own experimental research Timiriazev was first of all a physicist.

Note: "Physiology, - writes K.A. in his lectures "The Historical Method in Biology, - is only the physics of living organisms" (Works, v.VI, p.41).

This characteristic of Timiriazev has been bluntly expressed in his attitude to the physiology of the movements of the vegetative organism. Here he also was inclined to the physical model of the surveyed phenomena. The perserverance by which he defended in this field any attempt of "mechanical explanation" of the physiological processes was intensified by the realization that here the materialistic and Darwinistic ideas concerning the organic world are threatened. According to K.A.'s opinion, the rejection of mechanical ideas in this domain of plant physiology would support the vitalistic theories. In the foreword to his "Life of Plants", (1912) of the English edition Timiriazev writes: "I suspect that many among my botanical colleagues will find some ideas of the seventh chapter out of date, but I must sincerely admit that the reference to the sound ideas of Nait (Knight?) or DeCandolle, Diutroshe or Hofmeister is desirable during the spreading of Reizphysiologie which could become quite dangerous. I am convinced - he says further - that the models similar to those suggested by DeCandolle for the explanation of the phenomenon of heliotropism or by

Hofmeister for geotropism, of course, if applied to the growing requirements of science, would renew the study of the mechanism of growth to the promising research", (Works, v.IV, p.22-23). And in confirmation of this point of view K.A. refers to the authority of the physicist G. Thompson who insisted that "even in the higher scientific spheres" the mechanical models are a powerful instrument for research.

This conviction which he borrowed from the physicists on the power and the prospective of "mechanical models" was the reason by K.A. defended in his chapter "Life of Plants", which discussed growth and tropism, actually insisted upon the points of view which occupied a scientific position during the first half and the middle of the nineteenth century. But at the same time he was unable to realize that these old attempts of mechanical explanation of tropisms is impossible to reconcile with the new data in this field found by Darwin and by his followers. In order to overcome this inner contradiction, it was necessary to reject the primitive schemes of Hofmeister, DeCandolle and other pioneers in the physiology of movement of the vegetative organism. But, as we already pointed out, rejection, according to Timiriazev, would mean loosing the position to the followers of the idealistic Reizphysiologie. He was unable to foresee that the science of the twentieth century will find a third road, that the problem of tropisms would be solved neither by physics nor by the physiology of stimulus, but by chemistry and by plant endocrinology, according to Darwin's assumption about the existence of auximone.

The realization of the impossibility of applying old mechanical schemes to the growing requirements of science which was based on Darwin's discovery in the field of tropisms was, from our point of view, the second source for Timiriazev's dual attitude to these discoveries.

K. A. Timiriazev died just a few years before that drastic change in the development of the physiology of growth and movement of the vegetative organism which occurred around 1925. Then the question arises: How would K.A.'s attitude be to this great event in the history of plant physiology, which evaluation would he give to this new hormonal theory of tropisms and to the entire doctrine of phytohormones which within 15-20 years developed into an independent department of phytophysiology and biochemistry with wide perspectives both in the domain of theoretical problems and in the domain of practical applications.

We have already seen with which kind of interest K.A. followed the development of animal endocrinology and which hopes he connected with the possible spreading of the doctrine about hormones upon the vegetative organism. The first steps in plant physiology into this new direction, interesting data obtained by Fitting, Gaberlandt, Leb and others before 1920, did not receive his attention and, possibly, were unknown to him. But we should not doubt that further achievements in this young science - phytoendocrinology - which led to a radical reconstruction of our conceptions concerning the mechanism of orienting plant movements would stimulate in K.A. his usual enthusiasm and hot approval.

Really, the first and natural result of this reconstruction was the crumbling of Reizphysiologie, the physiology of stimulus, so hated by K.A. The wide domain of phenomena - the entire doctrine on tropisms, from where the physiologists of this direction drew the material for their speculations, received an entirely new and strictly materialistic interpretation. Analogies with psychophysiological processes in animals became now impossible, and the complex ideology and terminology of the previous physiology of tropisms became absolutely unnecessary. Instead of attributing various forms of sensitivity to the top of coleoptile or to the root edge, we now speak about the production of auxin in these organs; instead of referring to means of moving "irritability" or "stimulus" from the sensitory zone into the motor zone we will examine the ways and means of the auxin spreading in the plant tissues, etc. The real nature of the phenomenon which has been called "perception", or "pertseptsii" became clear. It became evident that the external factors (light, gravity and others) during their effect upon the vegetative organ causes in the living tissues of the latter an electrical polarization. This electrical polarization causes the change in the growing hormone into any direction, depending on the direction of the light energy or the tracting power, etc. Changes in the growth of some parts of the organ which are hidden in its motor "reaction" come to the mechanism of auxin effect upon the growing cells. The speed of the growth of these cells in some plants increases the concentration of this substance, in others - decreases.

This basic change in our conceptions about the nature of tropisms and the growth of plants according to their tendencies corresponded to the general direction in the thought and scientific conception of K.A. Timiriazev. He would find satisfaction in concrete materialistic schemes and models which enable him to reduce complex phenomena of the living organism to more simple physico-chemical processes. It is now, that the physiology of the growth and of tropisms finally found its correct road bestowed upon us by the classics of natural sciences of the nineteenth century with Darwin as the head. Timiriazev always aimed to that road. Could we doubt that he would greet with great joy this historical event?

Darwin's research on the movement of plants were the first attempt to approach some basic problems of phytophysiology by ideas and methods of the evolutionary theory. As we have already seen, this attempt of the great biologist to elucidate the origin and the development of the most varied movements of the vegetative organism from the historical point of view received Timiriazev's high evaluation.

During the succeeding decades, the evolutionary ideas slowly, but firmly penetrated also in other divisions of plant physiology. The evolutionary trend in the study of phytosynthesis and of plant breathing achieved high success.

Phytoendloronology which originated in Darwin's work on plant movement cannot stand aside from this penetration of evolutionary, Darwinistic ideas into the physiology of the vegetative organism. In Darwin's doctrine, it may find necessary points in solving contradictory problems of principle which spring up with the growth of science which gradually embraces more problems. Science should make use of this doctrine in selecting ways and methods in colving its problems.

It is possible and necessary to consider the problem of the initiation of hormonal substances in the vegetative organism from the evolutionary point of view. We know that the chemical peculiarities of every living organism are caused by natural selection in the same manner as its morphological characteristics. In our case, various organical compounds which originate in the exchange of substances in small quantities are the material for the productive activity of selection. Among them we may differentiate useful, harmful and indifferent for the organism. The chemical nature of these compounds changes gradually depending upon external and internal conditions. Natural selection, while being active against that background, must strengthen those changes in the processes of metabolism which are followed by the production of useful physiologically active substances.

In considering from this point of view the initiation and the development of sprouting substances, it is not hard to see the process of their gradual complication and perfection - up to the production of those chemical instruments which act accurately and quickly, like auxin, heteroauxin, vitamins and various other physiologically active compounds with regulatory function.

The problem of the causes for the wide spreading of auxin in the vegetative world requires special attention. It is interesting to observe that a great amount of other biologically active substances which are formed in the cells and in the tissues of plants, for instance, all known vitamins, are of great significance also in the life of animals. Auxin does not belong here. The few data which exist in literature and which indicate that auxin regulates the early stages in the development of some vertebrates are seemingly erroneous. Other surveys which deserve more confidence determined that this substance does not have any physiological effect upon the growing cells of typical animals and it is not formed in their body as the product of their own metabolism. Auxin, which could be always found in the urine of the human and of herbivorous animals, penetrates into their organism through the vegetative food and without being exposed to changes, secretes through the kidneys. This is, seemingly, the fate of heterauxin, which is secreted by the bacteria of intesting microflora and which does not manifest any influence upon the physiological processes in the organism of animals and of humans.

Thus auxin is a specifically vegetative substance with a regulatory function which is widely spread in higher plants. In some respects, auxin, consequently, represents something analogous to chlorophyll, which is a specific vegetative pigment with which it is connected in its genesis. How is it possible to explain from evolutionary physiological point of view that circumstance, that auxin acquired a great physiological significance only in the world of higher plants, while the organism of animals is indifferent to it?

In order to reply to this question we should discuss the differences between the typical plants and animals. This topic often attracted Timiriazev's attention. If we sum up briefly his ideas in this field and also what could be found in other great biologists of the nineteenth and twentieth centuries, we arrive at the following:

The basic distinction between typical animals and plants "consists of the fact that a plant, being connected with the substratum, aims to develop the most possible surface in its continuity with the environment from which it obtains food, while the animal, forced to move in search of food, on the contrary, aims to the maximal decrease of his surface, to the decrease of the size of the body and to the formation of parts which contain organs important for survival". Note: N. G. Kholodnyi. "Darwinism and evolutionary physiology" Publ. Arm. filial Academy of Sciences USSR, 1943, p. 42.

This basic distinction between the typical representatives of two branches of organic nature, far divided from each other, determines their other morphological and physiological peculiarities. As to the higher plants, the immobile adherence to the substrate which does not permit them to move in space in toto limits their movements by bending their parts and organs. These limited movements acquire more significance, since only with their assistance is the plant able to distribute its parts in the environment most regularly, i.e., in a manner to fulfill its life function. As it is known, these movements are divided into turgor movements, or variation movements, and growing or nutation ones. The first ones are observed in leaves which accomplished their growth and in some parts of the flower. The second ones are spread more widely and are intrinsic to all organs of higher plants which have the capacity of growing.

An important role in the life of higher plants are playing tropisms, i.e., the growing movements which direct their parts in a specific manner in relation to important external factors - light, tractive power, humidity, heat, the content and concentration of nourishing substances, or of harmful chemical compounds, etc. in the environment. The mechanism of these movements has been clarified quite fully at the present time. As we already mentioned, they are based upon the ability of living growing tissues of plants to react upon the effect of physiological polarization, i.e., the emergence of some difference in the potentials in the direction of the effect of the external factor. Auxin possesses the capacity of transferring to the direction of the growing potential. Accumulated in specific parts of the growing organ, directed by external power, this substance causes here the acceleration and the retardation of growth depending upon the nature of the organ and upon the reached concentration. As a result of this process, a bending originates which has any direction related to the factor which acts outside.

Of all physiologically active substances, known at the present time, which are produced by the cells and the tissues of higher plants, auxin, it seems, possesses in highest degree the ability of diffusing in the growing tissues in the direction of the electrophysiological gradient. This explains the factor why natural selection attributed to it the role of the principal chemical regulator of growing phenomena in higher plants.

If we now turn to typical animals that possess the ability of free movement, then we can easily see that, due to constant transposition of their body, the electrophysiological polarization of their tissues under the effect of the environment, if it occurs, yet does not have the same significance as in plants. In this connection auxin is unnecessary as a regulator of growth. Only the sitting forms of lower animals (for instance hydroid polyps) which have, like plants, the capacity for tropical bendings could serve as exceptions. It would be interesting to examine the problem about the presence of auxin in these forms.

Thus, the primary significance of auxin in the growth and in the growth movements of higher plants is closely connected with their evolution which is related to the peculiarities of their nourishment and the absence of capacity to free movement in the environment.

As we have already indicated, Timiriazev was of the opinion that "the difference between plant and animal--is not qualitative, but only quantitative" (Works. v. IV, p.296). It is, therefore, impossible to overlook the fact that upon higher stages of the organic ladder the quantitative differences become qualitative. The basic difference of typical representatives of the animal and vegetative world is, naturally, reflected upon their entire organization. For higher animals is characteristic "the higher grade of anatomical and physiological differentiation...., the more refined and perfect specialization of their individual parts, their organs, the presence of a series of complicated mechanisms which assist in the speed and accuracy of the motor reactions". (N.G. Kholodnyi, 1, p.42). In the process of the evolution of animal forms "complicated "correlations between various parts of the organism caused the necessity in a perfect "relation service" which occurs in animals with the assistance of hormones and the nervous system. The presence of the latter, on the other hand, caused new complications into the hormonal mechanism by enriching it with substances which assist in the work of the brain and of the nerves. The same might be told about the digestive organs, sexual reproduction, etc. In connection with the progressive changes of any of these systems the entire mechanism of biologically active compounds produced by the animal itself developed and became more perfect".

"We observe in typical plants a different picture. The specialization of functions of individual organs and of tissues is here expressed less conspicuous than in animals. In reality, almost each living part of the plant at some degree possesses all the qualities of the entire organism and under favorable conditions is able to give it a start. The relation between various organs is also developed comparatively slight. According to the amount and the variety of the organs the vegetative organism, even the most complicated, is always inferior to the animal. Some functions, for instance the nervous function, are absent or could be disclosed only in the embryonic condition. Thus the structure of a plant is characterized by less differentiation, by the concentration of a larger amount of various morphological, physiological and biochemical potentials in each organ, in each tissue and in each cell". N. G. Kholodnyi, l.s. p.48-49.

These peculiar characteristics in the structure of a typical plant correspond with the peculiarities of the complex of biologically active substances -

phytohormones. In comparison with the hormonal mechanism of animals, this complex is inferior in its structure, and its individual components are less specialized as to their functions. The best studied phytohormone - auxin, which at first was considered the growth hormone, but which regulates the growth of cells during the stage of stretching, appeared to be the universal instrument of higher plants which has the capacity not only to influence the growth of all organs, but also on the division of cells, on the processes of morphogenesis and development, upon the exchange of substances, etc. This peculiarity of auxin which could be called its physiological polyvalence has no analogies in the animal world.

In summing up the above concerning the hormones of animals and of plants, we come to the conclusion that, if we like to consider the problems of phyto-endocrinology from purely Darwinistic, evolutionary point of view, as Timiriazev always advocated, then we have to keep in mind not only the characteristics of a basic similarity between animals and plants but no less basic differentiations in the structure and in the functions of typical representatives of these two branches of the organic world. Here arouses the necessity of being very cautious in all those cases when, as a result of the first and superficial acquaintance with some new group of hormonal phenomena of the vegetative organism, we notice an analogy between these phenomena and some physiological processes of higher animals. Timiriazev often in connection with the initiation of the physiology of stimulus in plants, of phytopsychology called our attention to the fact that such analogies, comparisons, may be quite dangerous and might lead to undesirable results, to ideologically and methodically inaccurate and unsound ideas in biology.

Unfortunately, the necessity of such a careful, dialectical and evolutionary approach to the problems of plant endocrinology has not been considered by all explorers who work in this field. In this domain originate various ideas which represent a considerable and doubtless similarity with those aberrations of biological thought which were criticized by Timiriazev so bluntly and correctly. We are referring here to the tendency of many contemporary phytophysiologists to attribute to higher plants the ability of forming and applying many and various, in chemical sense, hormonal substances with a specialized function. The first manifestation of such tendency was the idea of "tropohormones", i.e., specific substances with the help of which various motor reactions of plants - heotropical, phototropical and others - are carried out. They assumed the existence of a special substance for each motor form. This assumption was rejected when it became clear that the basis for all tropisms is the acceleration and retarding of growth caused by the same substance - auxin.

To this class of "plant anomaly" of contemporary phytoendocrinology we should also add the restoration of the old Sachs idea of organ forming substances which has been made fun of by Timiriazev,who found in this idea a basic similarity with the ideas of the alchemists and physicians of the Middle Ages concerning special "powers" present in medical and other substances and which determine their effect upon the human organism (virtus dormitiva, virtus purgativa, etc.). The same "alchemical aftertaste" is present in all rhizocalin, caulocalin,xernalin, antogene and formagene, which are mentioned in many works dedicated to the hormonal phenomena of the vegetative organism.

K. A. Timiriazev often repulsed the attempts of our own and foreign vitalists to explain the movements of plants by their "instinctive tendencies" or by similar causes. Thereby he indicated that such attempts indicate "a certain mental laziness" and "readiness of lulling one's self with words" (Works, v.VI, p.44). It seems that the adherents to hypotheses in specialized phytohormones and in organ forming substances are not free from such shortcomings. Really, it is easier to admit the existence of some "formagene" than to start on the complex road of physiological and biochemical analysis of the complicated complex of internal conditions which are necessary for the realization of some stage of normal morphogenesis or for its change. In the development of science such pseudo elucidations play, undoubtedly, a negative role. Fooling by their seeming simplicity, they lull the thought of the explorer and divert his attention from the problems which demand a deep and varied study.

For those who are well acquainted with Timiriazev's points of view, there could be no difference in opinion in the question how would be K.A.'s attitude to the flourishing of "physiological alchemistry" which we witness at the present time. There is no doubt that it is not new in its essence and represents further development of Sachs' idea.

But it is not enough to judge any phenomenon; it is necessary to find its causes, to understand its origin. Timiriazev taught us, that in the development of each science and of each branch in science there is its logic, that the springing up of any scientific theory, the temporary supremacy of any trend is always a result of a logical and dialectical process of the evolution of ideas based upon the widening and deepening of our factual knowledge.

And if we try, from this point of view, to approach that course of contemporary phytoendocrinology which we were discussing above, then it will be easy to perceive that it originated as a direct result of outstanding progress achieved by chemistry in examining some natural and synthetically obtained substances of a tremendous biological activity. Here we have before us a quite common example of an extreme infatuation by a certain idea, by a definite trend of thought, which are at the first impression outstanding discoveries.

In our case, the discovery of auxin and its analogues gave the impetus to the "scientific agitation", or, rather, "golden fever" in science. The most zealous "gold hunters" hurried in making many "reports". And we should not doubt that the majority of the latter will be reports on empty sands.

K. A. would observe another negative peculiarity of many contemporary studies on hormonal phenomena of the vegetative organism & the narrow chemical approach, the underestimation of the purely physical understanding of these phenomena. It was Timiriazev who expressed the thought that physiology is first of all the physics of living substances (Works, v. VI, p. 41). And if we look closer to the wide group of work dedicated to the phenomena of photoperiodism, then we would be surprised by the absence of the physical thought in this domain. But the living green plant is not only a complicated chemical laboratory; it is also at the same time an extremely sensitive physical instrument which responds to each external effect by more or less drastic changes in its physical and consequently, physiological properties.

At the present time, much attention is given to the photoperiodical stimulus which occurs in the plant. It is very possible that this phenomenon is connected with the transfer of substances of the phytohormone types from the leaves to the vegetative stem tops. We know already that the movement of the phytohormone - auxin - in the vegetative organism depends upon the distribution of electrical potentials, i.e., the pure physical condition of the organs and of the tissues of the plant. But, when the spreading of the photoperiodical stimulus is examined, we usually forget about the physical side of this pehnomenon. If our physiologists should follow Timiriazev's suggestion, then their main task is to elucidate the problem from this very point of view.

V.

In January 1890 in a lecture on factors of organical evolution delivered at the general meeting of the VIII convention of Russian natural scientists and physicians, K. A. Timiriazev mentioned the origin of a new branch in biology - the physiology of form or the experimental morphology of plants and predicted that this just starting branch of science will reach its peak during the twentieth century. This prophecy has been realized and the works of Föchting, Hobel, Klebs and others laid a firm start to the experimental plant morphology. K. A. highly evaluated Klebs' research which explained the possibility of arbitrarily changing and regulating the processes of formation of forms and of the entire life cycle of higher and lower plants. By acting upon the developing organism through some factors of the external environment (light, temperature, moisture, etc.), changing its intensity, quality, the length and the time of the effect, or applying them at various combinations, it became possible to direct the processes of form production, according to the intentions of the experimenter, into any direction, retard or accelerate sexual reproduction and even cause the initiation of new formations and new forms which did not occur with the given plants under regular conditions of its existence.

It is not hard to realize why K.A. greeted so wholeheartedly the first achievements of the young science: they were excellent confirmation of his basic conviction that "at the last instance behind the morphological facts should stand the chemical and physical properties of the substance" (Works, v.VI, p.381).

What great significance K.A. attributed to the experimental morphology could be noticed from the fact that he placed it along with Darwinism: "Darwinism.. and experimental morphology... - we read in the same speech - are two branches of science which are of equal rights and which mutually supplement each other. We expect a complete answer to our question concerning the relative role of factors of organical evolution from these two branches. "(Works, v.V, p.141).

Over fifty years have gone by, since Timiriazev wrote these lines. The progress achieved during this time by the experimental morphology of plants is great, but still it does not justify the hopes of Timiriazev as to this new branch of biology. It is true, the direction which has been outlined by Klebs' research received further fruitful development, especially in our country where the foundation for stage analysis of the ontogenesis of higher plants has been laid. But the study of the stage development, of its present condition does not comply with the requirements of K.A. to the future "physiology of form" of the vegetative organism. Here the border which divides ecology from genuine physiology has not been crossed. Under genuine physiology we understand the one which is based upon the knowledge of "chemical and physical properties of the living organism" and changes which occur in that organism during the process of individual development.

One of the reasons for this stagnation which occurred in experimental morphology of plants after the first outstanding achievements is the one-sided approach to the problems connected with it. This narrowness is expressed, for instance, in the prevalence of the interest to physical factors of morphogenesis - at the expense of the chemical side of the phenomena - and second, we don't devote sufficient attention to the internal environment of plants, while that very environment and, mainly, its active chemical components directly change those qualities of the living organism upon which depend the morphological, physiological and all other peculiarities of each organism. Already Darwin noticed the great significance of internal chemical factors. He indicated that "great and secret changes in the structure of the organism could be a difinite result of chemical changes in the nourishing juices or in the tissues". Ch. Darwin. The variation of animals and plants under domestication, v. II, p. 271, N.Y. 1899. This very conclusion which, in applying to vegetative organisms, Darwin based upon his observations of galls, led him to the idea about the possibility of experimental study of transformation with the help of the effect upon the organism by various chemical compounds.

The defiance to the chemical side of morphogenesis of higher plants is explained partly by the fact that the basic mass of nourishing substances (plastic and energetic material) is little active in the sense of their influence upon the morphological qualities of plants. Therefore Darwin's thought was directed towards a specific group of substances which possess the ability of causing a considerable effect under slight concentrations, i.e., of the physiologically active substances. Darwin knew only about active substances secreted by insects. At the present time we possess wide information concerning chemical regulators - phytohormones which are produced by the plants themselves. We also are able to synthesize many and varied substances which resemble phytohormones in their physiological effect upon the vegetative organism. Thus, we possess much more material in solving the problem which, according to Timiriazev, "was initiated by Darwin with such outstanding perspicacity". And we may insist that now is the time to begin those surveys which were only outlined by Darwin.

The first experiments in this direction indicated that here, a new wide field is open for the experimenter. This field promises a rich harvest in the sense of widening out knowledge concerning the laws of changes in the vegetative organism, of penetrating into the secrets of the mechanism of morphological phenomena and of finding new methods in directing the form organization and the development of higher plants. For the survey of the data obtained already in this field, as for instance, colchicin, we would have to write another article. In order to avoid passing beyond our theme, let us discuss here a few examples which pertain to the experiments with auxin and with, so called, synthetic growing substances which, according to their physiological qualities, is similar to that typical representative of the group of phytohormones.

The first data which revealed the influence of auxin upon the structure of plants were obtained by the author of this article in 1931, when he succeeded in causing the formation of a considerable thickening in the apical part of the tip of the growing root of corn, by introducing auxin in that part, and also to stimulate the initiation of side and supplementary roots. Then followed a series of work of other explorers among which our special attention should be given to the numerous experiments on the stimulus of root formation in grafting various wood and bush varieties which gave us important results, as well as the research of Laibakh and Mai (1936) on the experimental obtaining of anomalies of organ formation within some higher plants. Acting upon the axil buds of the grafted young plants with heteroauxin, the authors discovered in the leaves which developed from these buds a series of deviations from the normal morphogenesis. These deviations caused the simplification of the form of the leaf, the growing of several leaves into one and also other changes. Still more outstanding anomalies of the organgenesis were recently described by the American explorers Chichkov and Tsimmerman (1942) who applied "triidobenzoinyi" and phenoxin acids and their various derivatives. These authors were able to cause blooming, where usually only vegetative buds appeared, by applying the above mentioned substances.

In order to give to the reader a more concrete idea on the amount and the characteristic of the transformation in the morphology of the leaf which could be obtained by means of the effect of physiologically active substances like auxin upon the leaf sprouts, we are giving here a few schemes from the work of the author of this article with his assistants which has been recently published. N. G. Kholodnyi, G. D. Iaroshenko, A. L. Takhtadzhan. To experimental morphology and teratology of leaves. Botanical Magazine USSR, v. 29. Issue 4, 1944.

On the scheme 1 is presented a leaf of a linden tree (Tilia cordata) which developed upon a water sprout which appeared at the base of the trunk of the old tree when the top of this sprout obtained from outside the solution of heteroauxin for some time. This leaf has the form of a funnel. Normally such leaves never grow neither on Tilia cordata, nor on other linden species.

On the scheme 2 we see a normal triple leaf of legume (bean?) (phaseolus vulgaris); upon the scheme 3 - abnormal pinnate leaf of the same plant, with two pairs of leaflets, which was formed from a leaf sprout upon the main spindle of the plant whose top has been covered with lanoline which contained heteroauxin. From the moment of applying lanoline until the photographing and etching of this leaf only 20 days passed by.

Scheme 4 presents a leaf of beans which consists only of two leaflets, whereby the right one, which is larger, was formed by the blending of the uneven upper leaflet of the normal leaf and of one of the even lower leaflets. This leaf has developed during 50 days from the axile bud which was covered with lanolin containing alfa-naphtacidic acid. In order to stimulate the development of the axile buds the plant has been decapitated.

Finally, on scheme 5 we see abnormal leaf of the same plant which has been developed also from axile bud covered with a paste which contained the heterauxin solution. This experiment lasted 35 days. Here both even leaflets almost completely blended with the leaflet of the uneven, and as a result a simple ~~leaf~~ cannolate leaf was formed. It is interesting that this leaf reminds the leaves of the bean sprout which appear immediately after the cotyledons.

Thus, we are able to cause in beans both the increase and the decrease of the division of the leaf plate by applying the same physiologically active substances. A very close analysis of the described cases indicated that the increase of differentiation results from the effect of more concentrated solutions of growing substances upon the leaf sprouts which are advanced in their development, with the direct contact of the latter with the paste. On the contrary, the decrease in the differentiation of the leaf is caused by a proolongated diffused (general) contact of weak solutions of the same substances into the leaf sprouts during the very early stages of their development.

From the described experiments we may arrive at the conclusion that under normal conditions the morphogenesis of the leaf depends in some degree on the concentration, distribution and duration of the effect of auxin and of other phytohormones upon the tissue of the developing leaf sprout.

Timiriazev, following Darwin, attributed great significance to the research of the grafted, or vegetative, hybrids. Recently, in connection with new experiments in this field, many examples of deviations from the normal form structure, under the influence of foreign substances which penetrate from the leaves of one plant into the growth point of the other which belong to another species, became known. The formative transformations which are observed during these experiments could not be explained by differences in the chemical nature of the basic assimilators; for instance, carbohydrates and albymens, since these substances are not active in the sense of their influence upon morphogenesis. The just mentioned data concerning transformations caused by the effect of the hormone mechanism in the form structure of leaves and of other plant organs enable us to assume that the mutual ihfluence of grafting and of wilding could be, in the first place, summed up to differences in the structure of the natural complex of phytohormones which is specific for any of the plants under experiment. This problem was not yet considered by physiologists and is waiting for its explorer.

In the same speech concerning the factors of organic evolution, indicating numerous examples of significant transformations in plant structure which could be caused in its ontogenesis with the assistance of physical factors, K. A. Timiriazev infers: "I consider that the above is sufficient to justify the condition that physiology already starts disclosing the mystery of the formation of growth forms, that it learns how to direct the formation of such forms" (Works, v.V., p.136). We see now that, a few years after the death of the author of these lines, physiology made one more step in the same direction, that it begins to reabh a new group of factors of form structure and of development of the growing organism - by chemical regulators of these phenomena whose effect is more conspicuous than the influence of physical factors. Chemistry leads us now into the more intimate processes of the living organism; it promises to disclose in the very near future those "great and secret transformations" in the structure and content of the living organism which both Darwin and Timiriazev considered as the basic cause for all chain of morphological phenomena which represent only the external expression of these internal changes. In entering this new and promising road, we should recall that it became accessible to us only due to the tremendous and fruitful work of Darwin and that his most talented Russian follower (disciple), Timiriazev, called us constantly to this road. Their ideas - of Darwin and of Timiriazev - will also further serve us as a reliable guiding thread in solving regular problems of the growth and the development of the vegetative organism.

AMF
September 6, 1951. End of Book.

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R-50

M. Maksimovich
In Selskokjoziaistvennaia entsiklopediia
[Agricultural Encyclopedia], vol. 3
Moskva, 1934

App 17

Translated in part by
S.N. Monson

PROBLEMS OF POTATO SEED GROWING (p.26-27)

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Prior to the revolution seed growing work on potatoes was practically nil. The individual cases of importations ~~of importations~~ of potato varieties from abroad by landowners' and kulak households were of a non-systematic nature, and lacked records concerning the quality of the imported variety and its suitability for economic and soil conditions of the respective regions. Mixtures of different varieties prevailed in peasant sowings. Following the October revolution selective-seed growing work developed on a much larger scale. In 1927 potatoes were included in the GOSSORTFOND (Govt..Varietal Fund) and the subsequent distribution of the seed material proceeded according to a plan of which the principal aims were the standardization of potato varieties, the establishment of a rational system of propagation, the delivery of seed varietal material into collective and state farm fields, and the regular (systematic) replacement of non-varietal potatoes with specific varieties.

The system of potato seed growing is based upon a three-unit scheme. The "reproduction" of selective varieties of potatoes is taken care of by the VNIIKH (ALL-Union Scientific-Research Institute of Potatoes) and its zonal stations located in five areas of the USSR. The material for the first reproduction is obtained every year from the selection departments of these institutions and represents the top varieties tested in a variety of conditions throughout the country. The entire yield of the first "reproduction" is transferred to the second "reproduction" which is taken care of at special seed growing state farms of the Narkomsem of the USSR. Each oblast has several of these state farms. The entire yield of the seed growing state farms is next transferred into the system of the third "reproduction" within the oblast seed growing collective farms united under the MTS (Machine Tractor Stations). The varieties of potato tubers are further transferred from the third "reproduction" stage, by way of interchange, for mass sowings at collective and state farms. At present the Institute of Potato Economy and its sub-divisions have issued tens of thousands of tons of valuable selected potato varieties which have been transferred through the seed growing network to the commercial sowings of collective and state farms. Conditions for introducing changes in potato varieties have also been created under the second Five-Year Plan.

All varietal seed growing sowings are under the special control of the GSI (Government Seed Inspection) which gives its approval to the selected potato variety for field growing (examination of root). The approval establishes the varietal purity and health of plants, and if the varietal mixture and the number of diseased plants do not exceed the norms established by the standards established for seed potatoes (OST 4630), these sowings are given an approval certificate which testifies to their quality and suitability for seeding purposes. In order to identify the varieties of potatoes most suitable for the different regions of the country, a geographical testing is performed of the most potential varieties of potatoes (about 200 varieties at 120 diverse points of the Union). As a result of this work the best varieties were established, i.e. those most suitable for wide propagation within the boundaries of the USSR. On the basis of these varietal tests in different regions, the VNIIKH has worked out the following scheme of varietal regionalizing of potatoes in the USSR (Table 3). (See photostatic illustration of this table, attached.)

In connection with the movement of potatoes to the extreme north the question was raised of propagating potatoes from seeds, since the transportation of tubers to these regions is extremely difficult. Tests of growing potatoes from seeds are undertaken on a large scale in different border areas of the USSR. It is planned to grow potatoes from seeds on a plot of 1000 hectares in 1934.

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End of article.

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R-70

Veselovskii, I. (Professor)
Potatoes in the Altai Territory
Sovkhoz. Proizvod. 6(2/3):30.
Feb./Mar. 1946. 20 So85

Translated from the Russian
by S. N. Monson

In organizing seed growing of potatoes in any area of our country, the ecological conditions of the potato's birthplace have to be always borne in mind. Under these conditions potatoes are healthiest, i.e., free from disease, degeneration, and from so-called virus diseases. Generally speaking, moisture is a primary prerequisite for highest possible yield. Highest yields of potatoes were obtained on irrigated (?) ("polivnykh") lands (America).

Mineral substances (potassium, phosphorus, sodium), as basic fertilizers and additional feeding are best absorbed by the plant when moisture is present. It is known that at a temperature of 29°C., the transfer of plastic substance from leaves into the tuber is delayed and that at high temperatures it stops altogether.

The Altai Territory is extremely varied climatically. Meteorological data has established that the regions provided with the highest degree of moisture are Oirotia (to 900 mm.) and Biisk (to 400 mm.). Kulundinskii region has from 160-200 mm. of precipitation.

Oirotia is a high mountain region. The railroad network is but lightly developed, and the introduction of potato culture consequently restricted, particularly with respect to transport. In addition, potatoes freeze even as late as the end of June in the high mountains of the region. Earliest varieties of potatoes have to be moved here to take advantage of the brief vegetative frost-free period and prove productive under the circumstances.

Declassified and Approved For Release 2013/03/22 : CIA-RDP80R01426R009900020001-4

Vernalization will equally be of considerable aid to the artificial lengthening of the vegetative period, since it will permit the tuber to begin its life course no less than one month prior to planting and the transplanting of potatoes ~~may be done~~ ten days before the last frost.

The Biisk region is particularly favorable for potato growing because of its high precipitation, fertile soils and regular relief. Among the best locations in the Biisk region are the fields distributed close to the main water line of the river Obi. In the future it will be easy to move varieties of potatoes down this navigable river in exchange for common local varieties.

According to data furnished by the West-Siberian Vegetable Experiment Station and the Pushkin Agricultural Institute in the Pavlovsk region of the Altai Territory, the best canker-resistant potato varieties are BERLICHINGEN and of the earlies - COBBLER. Considerable attention should be devoted to the introduction of canker-resistant potato varieties to the Altai Territory.

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End of article

2-20-51

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Zaitseva, N. D.
Starting Material for Potato Selection.
Selek. i Semen. 17(7):31-37. July 1950.
61.9 Se5

Translated from the Russian by
S. N. Monson

The manifold and responsible tasks that confront us in potato selection demand the widest study and utilization of starting material, not only of cultivated but also wild potato forms. Our selectors have already succeeded in obtaining new valuable potato varieties and seedlings by hybridizing cultivated varieties with wild and primitive species (Institute of Potato Industry, VIR, etc.). Below is given a description of some species of potatoes which may prove useful in selection work when dealing with starting material of diverse species. The enormously rich data obtained from the collection of potato species gathered by S. M. Bukasov and S. V. Yuzepchuk served as a basis for the above studies.

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According to the system introduced by Bukasov, the section Tuberarium, to which potatoes belong, is subdivided into the following groups: Commersoniana, Cuneolata, Tuberosa, Articola, Acaulia, Andreana, Conicibaccata, Lignicaulia, Juglandifolia, Demissa, Longipedicellata, Cardiophylla, Bulbokastana, Oxycarpa, Polyadenia, Pinnatisecta, Borealia.

Of greatest significance for selection are the groups: Tuberosa, Demissa and Acaulia. To cultivated species of Tuberosa belong: S. tuberosum, S. andigenum Juz. et Buk., S. pureja Juz. et Buk., S. Rybinii Juz. et Buk. and others. To the wild species of Tuberosa belong: S. aracc papa, S. leptostigma, S. molinae, and others. S. leptostigma and S. molinae are closest to S. tuberosum.

Among other groups of greatest significance are the species: S. demissum Lindl, S. semidemissum Juz., S. punae, S. depexsum Schreiteri, S. Jamesii Tor, and several others.

Within the limits of the group Tuberosa only S. tuberosum forms tubers well on a normal day. The remaining species of tuberosa, as well as the rest of the species enumerated above, produce tubers under our conditions only in a short day (8 to 10 hours), a circumstance closely connected with the history of their origin.

Close to 3,000 selected European and North American varieties belong to the species of S. tuberosum. Selected varieties possess many valuable economic characteristics. In some instances their yields produce 128 tons per hectare and their starch content amounts to 28 per cent and over. The production of inter-species hybrids of high yields is therefore hardly possible without the participation of selected varieties.

Satisfactory results were obtained also with regard to tests on early maturing, resistance to various diseases, canker in particular.

There are indications in literature that the varieties Chippeva, Katahdin and Messaba are resistant to individual viruses, the variety Phytophthora-Resistant and others to phytophthora, the varieties Lorkh and Wohltman to ring rot. There are varieties which combine resistance to canker and phytophthora, such as the hybrids Cameraza. To S. tuberosum belong also the large number of diverse forms, imported by the members of the Expedition of the All-Union Institute Plant Industry (VIR) from Chile, South America. This collection, judging from its description in literature and our own observations possesses a group of forms which are very close to selected varieties, such as f. roseum (close to Early Rose), f. palmeta (Up-to-date); corailla (Sossis(?) rouge). In their total mass they are distinguished from selected varieties by the considerable variegation of their tubers, lower yields, low contents of starch and poorer keeping quality. The yield per clump is somewhat smaller than in cultivated varieties, although the yield of several forms reached 2.0 kg. per clump in some years.

Several forms of S. tuberosum from Chile possess very valuable qualities. Thus, according to data provided by F. A. Novikov, Elegans latum, Villa royal, 8835 chilotanum, indianum 8851, caballera 8911, liza 8901 withstand dry soil and the influence of high temperatures.

Of 24 tested Chile specimens, 22 proved resistant to canker, among them Chilotanum (8829, 8832, 8835), Viride, etc. When artificially infected with ring rot and black leg severe symptoms of infection were observed.

S. andigenum Yuz et Buk., as does S. tuberosum, is represented by a large diversity of species and forms (hundreds of varieties, according to S. M. Bukasov). Its characteristics distinguishing it from S. tuberosum consist in: the stem usually lying during blooming, almost all leaves provided with axil runners; internodes are elongated; leaves erect, sparsely placed, their spines almost straight, leaf lobes narrow. Peduncle is frequently widened into a lightly fluted base of the calyx; the anthers well developed, the majority of forms produce berries; S. andigenum has good tuber formation on a short day but several forms, as indicated above, form tubers without shade; stolons are mostly long. The average yield per clump during a long day is approximately 80 g. Individual forms, however, produce good yields, such as K-40, variety calvacia (1886), variety longibaccatum (1433). The starch content in tubers of this species is 8-24.6 per cent; the percentage of albumen varies from 1.4 (Mexican chalcoense) and others to 5.8 per cent (variety latacungense, etc.). As indicated by G. Kovalenko and I. A. Veselovskii, crossings with S. andigenum produce in the progeny seedlings of excellent yields, starchy tubers; they clearly prove the best components for purposes of obtaining high yields because of the ease with which they cross with S. tuberosum. This species matures later than S. tuberosum, is distinguished by considerably later sprouting, budding and dying of the foliage, and also has a much lengthier period of dormancy. The latter quality may prove valuable in the selection of varieties which do not grow in hot weather (see table).

SPECIES	Sprouts in days		Budding in days		Dying of Foliage from day of planting	
					115 days	150 days
	Korenevo	Rostov on Don	Korenevo	Rostov on Don	Korenevo	Rostov on Don
Tuberosum (14 selected varieties)	14.0	20.0	36.0	43.5	75%*	55%
Andigenum (14 forms)	19.4	28.2	47.0	66.5	28.5	32.1

*This data applies only to two selected varieties.

The resistance to canker is observed in the majority of tested forms of S. andigenum, such as Tarmense v. latius (8112), var. tenue (8121), ibag (8289), etc. According to the data obtained from an analysis concerning 41 forms, only two forms proved non-resistant, Lima and Liliacinoflorum.

S. DEMISSUM LINDL is represented by many forms. Its characteristics are a clump of rosette shape, a thin layer of downward lobes and a lightly pubescent leaf with truncated end. The receptacle is short; the lower part of the peduncle shorter than the upper; calyx small with short sharpened lobes; corolla small, blue-violet, unevenly colored, more so on the outside; anthers small, orange, on long threads. Fruiting abundant, berries more frequently elongated. Tubers white or white-blue, smooth, small, on very long stolons. Their yield produces 3-60 g. per clump; starch content 9 to 20 per cent; albumen 2.5 to 6 per cent. S. demissum Lindl is relatively resistant to frost. Many forms are resistant to phytophthora; tlapechualcoense Buk. (024, 029, 022/01), xitlense (09), Wilmoren (0249/056, 037, 0245/S-9, 0232/S-4). Seedlings obtained from the above forms are also resistant in their progeny.

The forms xitlense (010, 063) and the glaxpexualcoense Buk. (014, 023) are resistant to phytophthora but their progeny succumbs to the disease. There are forms resistant to phytophthora of which the progeny has not been studied: tlaxpechualcoense (022/S-6, 026, 030, 0222/012, 0223/S-5) and demissum (0250/028, 0220/010, 0247/S-1, 0248/S-9, 0233/S-91). This species is easily crossed with selected varieties and used for the production of phytophthora- and frost-resistant hybrids. The Institute of Plant Industry possesses many hybrids which when artificially infected over a period of three years did not produce symptoms of the disease.

Aside from that, the species is resistant to the Colorado beetle, is not affected by wrinkled mosaic but is susceptible to mottling. When infected artificially by black leg and ring rot symptoms of the disease were observed.

S. SEMIDEMISSUM JUZ. Tall clump, pigmented stem; the morphological characteristics of leaf resemble that of S. demissum. Receptacle, peduncle and calyx strongly pubescent and pigmented, corolla dark blue-violet, strongly pubescent on the outside; anthers orange, small, pistil protruding.

Under conditions of a moderate zone this species does not produce berries but at Pamir berries were obtained from it through cross pollination and crossings with cultivated varieties. Tubers white with blue shading, large, peeling; yield per clump 6 to 20 g.; starch content to 24 per cent, albumen 6.8 per cent. The species is frost-resistant, not affected by phytophthora. Many hybrids obtained from crossings with the variety Smyslovski (A. S. Filippov) did not get infected or were lightly infected by phytophthora. S. semidemissum Juz. is susceptible to mottling; when artificially infected with black leg it proved resistant.

S. CURTILOBUM JUZ. ET BUK has a rosette-shaped clump, strongly pubescent leaf with pronounced veining and very lightly serrated. Corolla large, blue-violet; occasionally produces berries. Tubers white with blue spots and smooth skin; yield per clump about 50 g.; starch content 14 to 24 per cent, albumen 3.7 per cent. Resistant to drought and frost. Under severe northern conditions produces frost-resistance hybrids in its progeny but in the Leningrad oblast its frost resistance is not high. This species, according to Kovalenko, produces from crossings hybrids of high starch content in its progeny which cross well with cultivated varieties; non-resistant to phytophthora and wrinkled mosaic.

S. PUNAE JUZ. has a rosette-shaped clump, small leaves, sparcely placed, downward directed lobes with truncated ends. Peduncle colored, its lower part very long, upper short; calyx deep, green with short, sharp tips; corolla small, blue, with very short, strongly pubescent tips. Anthers yellow, small on long threads; stigma very large. Produces berries in abundance. Tubers white, round, small. Species is most resistant to frost, standing temperatures to 8°. Crosses with difficulty but lately, aside from the hybrid of Blagovidova, the Institute of Potato Industry has obtained by the mentor method a group of vegetative hybrids by utilizing the mentor of cultivated varieties which produce seedlings that are resistant to frosts in the progeny.

Non-resistant to phytophthora and lightly affected by mottling.

The species S. ANTIPOVICHII, according to Bukasov, is resistant to phytophthora under field conditions; according to the data provided by IKKH, the forms of Antipovichii album coloratum (471/1214b) and others are severely affected by phytophthora. In artificial infection with black leg and ring rot a large part of tested forms is severely affected.

The form NEO-ANTIPOVICHII (0272, 0276/058) did not show symptoms of infection by phytophthora when infected artificially but proved susceptible to mottling and spider-web tick. Morphologically this form is distinguished by its white corolla and lobes of leaves with sharply extended tips. Berries drop easily. Of poor keeping quality.

S. ANTOPOVICHII variety Martinecii is non-resistant to phytophthora but resistant to canker. S. MOLINAE has a tall clump, vigorous, strongly leafed with pigmented stem. Leaves are very large, lightly serrated; lobes wide, wavy margins, very long petioles; receptacle tall with light green peduncles, corolla blue with wide white stripes, very large; anthers orange, very large; on long yellow threads. Abundant bloom, occasionally form berries; tubers blue, smooth, long; yield per clump 30 to 350 g., starch content 13 to 19 per cent, albumen 3.5 to 4.5 per cent. Species is resistant to drought and canker, non-resistant to phytophthora, mottling and leaf roll. When artificially infected with black leg and ring rot was severely affected.

S. LEPTOSTIGMA has tall wide clump; stem pigmented; leaves very long, strongly serrated; lobes narrow, sparsely placed; margins wavy; receptacle strongly developed, occasionally has upper leaflets; buds green calyx has narrow sharp tips; corolla white, not large, strongly stretched tips, occasionally double-petalled; anthers yellow, of regular shape; pistil very long; ovary round; forms berries; tubers rose or whitem smooth, long, many eyes; yield per clump 30-220 g.; starch content 12 to 20.6 per cent; albumen 1.6 to 2.6 per cent; resistant to drought, non-resistant to phytophthora, mottling and leaf roll. When artificially infected with black leg and ring rot is affected by them.

S. COMMERSONII DUN. has green stem of sharp pigmentation in the leaf axils. Leaves lightly serrated, wide lobes on long stems. Inflorescence not forked, receptacle tall, calyx has short, sharp tips; corolla star-shaped, white with blue star; anther threads are long; stigma long; berries long, flat. Tubers stark white, smooth with numerous eyes; yield per clump 15 to 100 g.; starch content 13 to 19 per cent; albumen 3.7 per cent; crosses with difficulty with selected varieties; resistant to Colorado beetle; some forms resistant to frost and canker.

S. CUENCANUM JUZ. ET BUK. Stem green, brightly colored in axils; leaves small, light green, with strongly sharpened tips; wide end lobe, serrated; lobes sparsely placed on long stems; corolla large, dark blue-violet; anthers small, on thin threads; stigma large; fruiting has not been observed under our conditions; at Pamir, however, has fruited, but the percentage of germinated seeds was small. Tubers on short stolons variegated, light blue, colored eyes on surface; yield per clump 20 to 60 g.; starch content 9 to 11 per cent; short dormancy period; early maturing; affected by phytophthora and wrinkled mosaic.

S. JUZEPCZUKII JUZ. ET BUK. Clump rosette-shaped, peduncle of not clearly defined joints; calyx regular, small, corolla blue-violet, resembles S. demissum, small anthers on thin threads; no berry formation; tubers small, yellow, oval, smooth, colored eyes on surface; yield per clump 10 to 100 g.; starch content 8 to 16 per cent; crosses with difficulty with selected varieties; resistant to frost.

S. DOLICHOSTIGMA. Stem green, leafed, narrow ribs and sharp pigmentation in axils; leaves large, long; lobes narrow on long stems with wavy margins; one to two pairs of small lobes; receptacle tall, at place of junction of peduncle a ring of pigment; corolla white, star-shaped; anther threads very long; stigma double-bladed; at Pamir this species formed berries; tubers oval, white-blue, spotted; eyes not deep; yield per clump to 250 g.; starch content to 19 per cent; albumen from 2 to 3 per cent; very poor keeping quality; resistant to drought and Colorado beetle; non-resistant to phytophthora and diseases of degeneration; affected by mottling; most resistant of all species to verticillium. When artificially infected with black leg and ring rot showed no symptoms of these diseases; very poor keeping quality.

S. PUREJA JUZ. ET BUK. Tall clump, lying, strongly branched; pigmented stem; leaf lobes narrow, small lobes round; stem of leaf, receptacle and peduncle pigmented; corolla of peculiar regular blue-violet coloring, tips pubescent inside; calyx fluted. Anthers orange, threads very long and thin; berries form seldom by self-pollination; tubers elongated, variegated coloring, from blue to white spots to beet red, numerous eyes, deep and colored; yield per clump 20 to 100 g. on a long day; starch content low, 7 to 12 per cent; albumen 3.2 to 5.3 per cent; good keeping quality in majority of forms, but several forms showed losses of 16 per cent; early maturing; non-resistant to drought, frost, phytophthora; severely affected by wrinkled mosaic; majority of forms resistant to canker when artificially infected with black leg and ring rot, the forms 8072 and 8076 did not show symptoms of the diseases.

S. STENOTOMUM JUZ. ET BUK. Stem thin, pigmented, small leaves, strongly serrated with small, narrow, sparsely placed lobes on long stems; corolla light red-violet, calyx has long sharp tips; tubers bright red and blue, numerous deep eyes; yield per clump varies from 15 to 100 g.; starch content 8.3 to 20 per cent; albumen 2 to 4 per cent; Mountain hydrophyte. Resistance to canker has not been sufficiently studied; severely affected by phytophthora, and wrinkled mosaic.

S. CANARENSE JUZ. ET BUK. Stem green; leaves have pronounced veining and are lightly serrated; margins of leaf lobes regular; corolla white, with short blunt tips, on peduncle a ring of pigment; anthers regular, yellow, threads short; produces berries; tubers yellow with red eyes; yield per clump 20 to 250 g.; starch content 10 to 11 per cent; albumen 1.4 to 2.0 per cent. No indication of being affected by wrinkled mosaic; non-resistant to phytophthora; very lightly affected by mottling and spider-web tick; when artificially infected by ring rot and black leg proved affected under observation.

S. RYBINII JUZ. ET BUK. Multi-stemmed clump; stem lightly pigmented; leaves light green with characteristic veining; end lobe of leaf is considerably larger than side lobes, lobes of first and second pairs run downward; receptacle not tall, on peduncle ring of pigment; peduncle and calyx colored; corolla white, not large, with short, blunt tips; anthers of regular shape, yellow; base of anthers has sharp cut-out; stem of pistil straight; stigma lightly protruding;

berries seldom formed; tubers white, round, small, have short period of dormancy; yield per clump to 300 g.; starch content 13 to 15 per cent; albumen to 3.2 per cent; poor keeping quality; non-resistant to drought, frost, phytophthora; severely infected by ring rot in artificial infection. No wrinkled mosaic observed, nor was infection of black leg noted when artificially infected; used in the production of early varieties in the south.

S. BOYACENSE JUZ. ET BUK. Stem weakly pigmented; leaf lobes round, sharp veining, light serration; first pair of lobes runs downward; distinguished from S. Rybinii (Bukasov) by larger serration of leaf, longer tips of calyx and red-violet corolla; berries form seldom; tubers rose, smooth, large; yield per clump averages 50 g.; starch content 15 per cent; albumen 0.5 to 2.8 per cent; poor keeping quality; early maturing species of brief dormancy; non-resistant to frost, drought and phytophthora; affected by mottling.

S. KESSEL BRENNERII JUZ. ET BUK. Leaves have very small, sharp veining, shiny, lightly serrated; corolla red-violet, evenly colored; bloom abundant; tubers bright red or white with red spots; small, of smooth skin, numerous eyes; yield per clump 70 g.; starch content 10 to 15 per cent; albumen 1.7 to 4 per cent; early maturing; non-resistant to phytophthora, affected by mottling and leaf roll; strongly affected by spider-web tick; when artificially infected by ring rot and black leg no symptoms observed.

S. BUKASOVII JUZ. Tubers white, round, small; yield per clump about 10 g.; starch content 14 per cent; forms berries; crosses with cultivated varieties; resistant to frost; affected by mottling and leaf roll; supposed to be resistant to canker and scab.

S. JAMESII TOR. Stem green, sharp pigmentation in axils of leaves; leaves small with downward running lobes; calyx has long sharp tips; corolla white, star-shaped, blue on the outside; pistil very long (double the size of anthers); stigma needle-shaped, ovary elongated; anthers of regular shape, yellow on long threads; berries infrequent; tubers white, smooth, oval, small; yield per clump 2 to 120 g.; starch content 12-16 per cent; albumen 4.2 per cent; species is resistant to canker and Colorado beetle; no symptoms of degeneration were observed; when artificially infected with ring rot and black leg no symptoms observed; non-resistant to phytophthora.

Institute of Potato Industry of RSFSR

End of article

3-5-51

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Gern, A. P.
Potato Varieties for Penza Oblast.
Sad i Ogorod 1948(8):70-72. Aug. 1948. 80 Sa13

R-31

Translated from the Russian by
S. N. Monson

In 1939 the following potato varieties were regionalized for the Penza oblast on the basis of data obtained from the Anuchin Experiment Station, the Petrovski Government Selection Station and the Grabovskii Distilling Plant. They were the basic varieties: Lorkh, Early Rose, Snezhinka, Petrovskii Yubileiny (Jubilee), Epicure, and the temporarily admissible varieties Wohltman and Smyslovski. In 1945 approved plantings of varietal potatoes, both standard and permissible, occupied 2.320 hectares or 97 per cent of the plots devoted to varietal potatoes of a total area of 2.390 hectares. Of these, Lorkh, Early Rose and Wohltman occupied 2.194 hectares, or 93 per cent. Considering the vast industrial production of the oblast (25 distilling and 9 starch-milling plants) and large industrial city centers, such as Penza, Kuznetsk, N. Lomov, Serdobsk, Kamenka, the available assortment of potatoes is unable to satisfy the economic demands of the oblast.

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Of the early varieties only Early Rose possesses industrial significance. This variety was until recently the most popular in the oblast. As a result of continued late plantings of small tubers against a background of poor agricultural practices, the variety degenerated and began producing low yields of tubers of little value. In recent years Early Rose has been supplanted in many regions by the variety Lorkh. As to the variety Wohltman, it is not distinguished by resistance of its tubers or its starch content under conditions of Penza oblast. To base all productive industry, as is done by the organization GLAVSPIRT (Principal Distilling Administration), on the variety Wohltman would mean to set up an orientation considerably inadequate with regard to yield and starch content.

Lorkh is the only variety that prospers in this oblast; it moved into first position in the war years with respect to planted area, dislodging Early Rose and in part Wohltman.

The satisfactory starch content of the variety Lorkh permits its use in technical processing. Basically it is, however, a table variety, intended chiefly for winter use. Its deficiencies are a relatively low commercial value (a high percentage of small tubers) and average taste, especially in the spring. In storage it begins to sprout early, usually in the second half of February, which reflects upon its taste qualities. The positive characteristic of Lorkh consists in its relatively early tuber formation, producing yields that considerably exceed the yields of Wohltman, Silesia and other varieties of this type.

The approved regionalization of 1939 cannot be considered very successful. The list of regionalized varieties contains many earlies and medium-early varieties: Early Rose, Epicure, Petrovskii Jubilee, Snezhinka. Such a number of varieties of this type is hardly necessary for the economy of the oblast. The problem concerning technical varieties for the oblast remained, moreover, unsolved.

The distilling and starch-milling industries require for the lengthening of their processing season an earlier technical variety, so that processing may begin earlier. At the same time the industries demand a variety of high yield and starch content for winter processing. It follows that for industrial sections two kinds of technical potato varieties are necessary, the medium-early of the type of Oktiabronok and the medium-late, found in the variety Promyshlenny.

It is hardly advisable to produce a special forage variety for the oblast. Table -. as well as industrial varieties may be used for forage. All that is necessary is for a potato to produce a high gross yield.

Taking into consideration the lack of correlation between the need for potatoes and the recommended varieties, the Petrovsk Government Selection Station ("Gosseleostantsia"), together with the Penza Alcohol Trust ("Spirttrust") undertook in 1944 varietal testing of potatoes in the oblast. At present data covering three years on varietal testing for the oblast is available. Thirty-three reports from 21 testing stations were obtained in these three years. This amount of data is ample for purposes of specific regionalization of varieties, but the irregular distribution of testing stations within the oblast interferes with the local regionalization of varieties. In all, 37 varieties were submitted for tests.

Table I lists data concerning tests of early varieties; table II the technical and table III the table varieties. Figures on the variety Lorkh are presented for comparison.

On the basis of work conducted in the past years with regard to varietal potato testing the following conclusions may be drawn:

1. The assortment of potatoes established in 1939 for Penza oblast is in need of substantial revision. The varieties Early Rose and Snezhinka should be transferred into the category of permissible varieties. There is no need to reexamine the categories Wohltman and Smyslovskii.

2. The varieties Oktiabrenok, Ostbote, Promyshlenny, and Petrovskii 164 should be considered potential for potato-processing industrial sections. The introduction of the variety Oktiabrenok into production should be accelerated. The variety Petrovskii 164 should be introduced in the location of the Shemysheisk starch-milling plant.

3. Among the group of earlies, Leningradskii is to be rated potential, at least for the suburban section of the City of Penza where this variety is propagated at present.

4. The varieties Promyshlenny and 102/385 should undergo wider testing since they exhibited good characteristics in many instances.

5. Lorkh should be considered the basic variety for winter use for the next few years and be introduced in all sections of the oblast.

6. Testing of early varieties for purposes of selecting a basic variety to replace Early Rose should be intensified. The variety Epron particularly deserves testing.

7. It is essential to curtail the number of varieties for testing by eliminating those which did not produce good results in varietal evaluation. The following varieties should be eliminated: Kalitinets, Stakhanovskii, Kronkhi,

14/1647, and the numbered seedlings of the All-Union Scientific-Research Institute of Alcohol Industry. Attention should be directed to the fact that regional agricultural departments do not participate in varietal testings of potatoes and fail to show any interest in the work.

The ("Goscommissia") Government Commission for Testing Vegetable Crops on the territory of Penza oblast lacks varietal testing plots for potatoes. It is essential that at least three government varietal plots be set up for potato testing in the Penza oblast, i. e., one plot for each natural-history (ecological) zone. The experiment station of the oblast does not conduct work on potatoes. The work of scientific-research institutions with regard to potatoes is conducted in an uncoordinated manner. As a result there is an accumulation of non-potential varieties at varietal test stations. Untested varieties, such as Stakhanovskii, totally unsuited for the oblast, are transferred into production. The agricultural administrative body of the oblast should become the coordinating center for scientific-research institutions, a condition which does not prevail up to now.

Table I

Name of Variety	Year of test	No. of Stations	Average yield c/h	% of average yield of Lorkh plantings
Early Rose	15	11	99.7	45.5
Snezhinka	11	5	123.5	56.4
Chippeva	8	6	191.6	87.5
Kalitinets	4	3	85.8	39.1
Petrovskii Jubilee	5	4	171.3	78.2
Leningradskii	6	4	168.3	76.8
Lorkh	28	18	219.4	100

Table II
TESTS OF TECHNICAL VARIETIES OF POTATOES IN 1944 to 1946

Name of Variety	Year of Test	No. of Stations	Average Yield c/h	% of Average Yield of Lorkh Plantings
Wohltman	11	9	144.8	66.1
Ostbote	18	11	171.7	78.4
Oktiabrenok	15	10	168.4	76.9
Sovietskii	9	6	145.4	66.4
Stakhanovskii	8	7	104.0	47.6
Promyshlenny	4	3	172.2	78.6
Petrovskii 164	13	8	205.5	98.4

Table III
TESTS OF TABLE VARIETIES OF POTATOES

Name of Variety	Year of Test	No. of Stations	Average Yield c/h	% of Average Yield of Lorkh Plantings
Lorkh	28	18	219.4	100
Berlichingen	13	7	162.6	74.2
Smyslovskii	12	8	161.1	73.5
No. 102/385	17	11	234.2	107.0
No. 14/1647	12	10	177.8	81.2
Kronkhi	8	1	114.7	52.4
No. 6194	7	3	121.0	55.2

End of article

3-2-51

Karpenko, P. V.
Sveklovodstvo (Sugar beet cultivation).
Moscow, 1950. 302 p. 66 Kä43

Transl. 111: Sugar Beets
Translated in part
by S. N. Monson
SB 206

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L.A.B.
9/4/1951

Transl. 111

Karpenko, P.V.
Sveklovodstvo; Sugar Beet Cultivation
Moscow, 1950 66. K143

Chapter I. (p. 7-11)

SIGNIFICANCE OF SUGAR BEETS FROM THE STANDPOINT OF NATIONAL ECONOMY

FOOD VALUE OF SUGAR BEETS

Sugar beets and their residues possess great and varied significance for the national economy of the country.

Roots of sugar beets are rich in carbohydrate and serve as raw material in the manufacture of sugar.

Sugar represents the basic and most widely used carbohydrate in nutrition; it is well absorbed by the human organism and possesses superior tasting qualities. In characterizing the role of carbohydrate including that of sugar, in the life of man, it is necessary to point out that although albumen and fats are important as high caloric products in the balance of energy in the human organism, hydrocarbon (starch and sugar), which represent 3/4 of the total food intake in nutrition (in calories over 60%), serves as the basic source of muscular energy and other human activity. Medical practice established that death is invariably accompanied by a drastic drop in sugar in blood. Healthy people possess a steady definite amount of sugar in their blood, i.e. the amount of sugar in blood does not drop below 0.09%, nor does it rise above 0.12%. Physicians-physiologists further consider that fatigue is accompanied by loss of sugar in blood. Sugar as a nutritient is therefore one of the main factors contributing to the preservation and rapid restoration of working ability.

Among cultivated plants the sugar beet is one of the high caloried plants. It surpasses many other cultivated plants in total amount of calories per unit of area.

FIELD AND INDUSTRIAL RESIDUES OF SUGAR BEETS

Field residues of sugar beets (leaves in first place) equal good hay in quality. The foliage of sugar beets represents 1/3 to 1/2 of the root weight in the principal regions of their cultivation, or in other words, in an average yield of beet roots of 250-300 c/h, leaves ~~expressed~~ represent 8-150 c/h. In the north, in non-chernozem oblast(s), (as well as in other regions on well fertilized and moist plots) foliage at time of harvesting may amount to 100% of the weight of beet roots. Tips, the cut-off ends of roots are also included in sugar beet residue. Field residue of sugar beets represents a valuable food item for domestic animals. Its chemical composition (outside of the crown) contains between 11.3 and 20.4% of dry substance, including albumen - 2.3 to 3.2%, fat, about 0.4%.

Sugar beed foliage also contains vitamins. In the non-chernozem belt and other regions sugar beets acquired the reputation of a splendid forage crop. Among juicy forage crops in the non-chernozem belt sugar beets, according to the All-Union Scientific-Research Institute of Forage Crops (imeni R.V.R. Williams) produce the highest yield in amount of dry substance per hectare. The plant is further characterized by its high forage value (root and foliage); beets as feed crops are far superior to other forage root crops.

The high forage value of sugar beets was established in practice at advanced collective and state farms where it was used as forage for pigs and dairy cattle. Thus the Stakhanovite in husbandry, A. E. Luiskova (coll. farm "Budennovets", Mezhdurechenskii region, Vologodsk oblast') showed that by feeding pigs with sugar beets the need for concentrated food is greatly reduced, the milk output of mother pigs is increased, and fattening of pigs proceeds more rapidly. Good results were obtained also from stakhanovite farmers of Vologda oblast' in feeding sugar beets to dairy cattle.

Residue of sugar beets is of considerable significance as forage; it is secured through industrial processing (plant residue) in the form of sugar beet pulp and molasses.

Pulp represents leached beet shavings after the extraction of water; it contains 15% of dry substances which include (in %): raw protein, 1.3; raw fats, 0.1; non-nitrogen extractable substances, 9.9; cellular tissue, 3.0; ashes, 0.7. Pulp may be fed to domestic animals in raw, dry and pressed form. In its raw (fresh) form, immediately upon receipt from the plant, it is used as forage for large horned cattle. If used for the same purpose at large distances from the plant, it is pressed or ensiled. In ensiled form pulp represents a valuable forage for working oxen (less suitable for dairy cows and pigs). Dry pulp resembles concentrated forage in quality. Pulp is also used as a raw material in the production of pectin glue.

Of extreme value in sugar beet processing are molasses. Their chemical composition depends upon the process of beet processing at the plant, as well as upon the quality of the raw product, which in turn depends upon conditions under which the beets were grown (soil, fertilizers, weather conditions during the vegetation period), the specific sugar beet variety, and periods and methods of storing of crops in the period between harvesting and processing. The average content per 100 parts of dry substance of molasses is: organic elements, 90.2-91.5%; ashes, 8.5-9.8%. Organic elements of molasses contain (in round %); general nitrogen 15; sugar 60;

non-sugar 8; pectin substance 3; non-nitrogen extractable substances 15.

Molasses are used as forage in mixtures with other feed, especially hay, as well as in preparing mixed feed.

Molasses have also large industrial value. They are used by distilling plants as a raw material for producing alcohol and by glycerine plants for the manufacture of glycerine.

In the process of cleaning juices at sugar factories (on filter presses), muck, a residue, represents a valuable lime fertilizer. Muck when used as a fertilizer increases sugar beet yields and other crops under rotation considerably.

AGRO-TECHNICAL SIGNIFICANCE OF SUGAR BEETS

The sugar beet raises the general productivity in field crop rotation. This is the result of the high yield of sugar beets (in estimating dry substance per hectare), compared to other field crops, as well as of its positive influence upon yields of other crops under rotation, primarily grain crops.

Summer crops especially succeeding sugar beet in direct rotation, produce higher yields than if they follow other predecessors. Thus in fields of Chernigov oblast' (Nosov Experiment Station), oats planted after sugar beets steadily produced over a period of several years high yields compared to plantings ~~after~~ succeeding rye crops; in c/h):

	First Test	Second Test
Succeeding rye	17.69	18.44
" sugar beets	21.45	20.70

Tests made at the same station of yields of oats succeeding other predecessors in crop rotation with sugar beets showed them to be higher in those instances when these predecessors were planted on sugar beet fields.

Predecessors of Oats	Yield of Oats in C/H
Oats succeed rye	14.1
" " sugar beets	16.3
Millet succeeds rye	16.3
" " sugar beets	18.5
Peas succeed rye	20.1
" " sugar beets	22.8

The station also obtained the following results on yields of winter rye in crop rotation with sugar beets and without the latter:

Links in Crop Rotation	Yield of Rye in C/H	
	Grain	Hay
Vetch - rye - oats	19.0	46.6
Vetch - rye - sugar beets	22.3	61.1

At Ramona Selection Station (Voronezh oblast') the influence of sugar beets upon yields of other crops under rotation produced the following results:

Crops	Average Yield in Several Years (in C/H)	
	On Sugar Beets	On Winter Crops
Vetch with oats (over grain)	19.2	17.8
Setaria italica P.V. (Hungarian or Italian millet)("mogar")(on hay)	33.7	27.6
Sudan grass (on hay)	49.3	41.6
Peas on grain	15.5	14.3
Millet, on cereals	18.8	16.0
Oats, on cereals	20.3	18.4

The positive influence of sugar beets upon yields of subsequent crops and the general productivity of crops under rotation are confirmed by numerous other data from scientific institutions.

The highest positive action exerted by sugar beets upon yields of other crops is obtained under conditions of proper grass-field crop rotation and high-grade cultural treatment: deep fall plowing after disking stubble, fertilization of plants, their proper care, etc. Under poor cultivation of the soil, and neglect of fields at a time when care should be given sugar beet plants, their role as predecessors is drastically curtailed.

End of chapter.

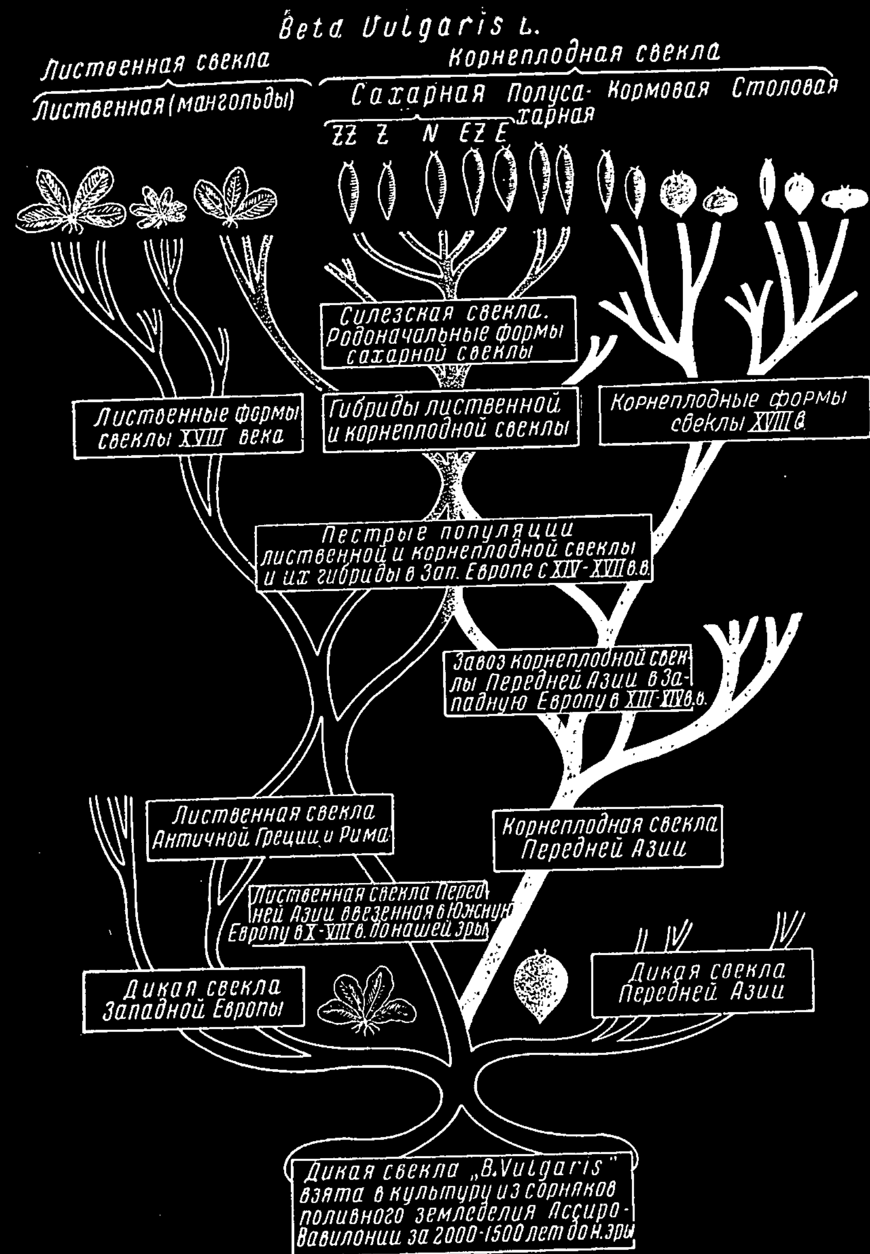

Рис. 2. Схема происхождения культурной свёклы Beta vulgaris *L.* (составлена В. П. Зосимовичем) (*ZZ* — ультрасахаристые формы, *Z* — сахаристые, *N* — нормальные, *EZ*—урожайно-сахаристые, *E*—урожайные).

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Karpenko, P.V. Transl. 111
Sveklovodstvo; Sugar Beet Cultivation
Moscow, 1950 66.K143

Chapter III. (p. 17-24) (photostat in duplicate)
HISTORY OF BEET CULTURE

The study of species and forms of sugar beets, their biology, geographical distribution, and other historical data concerning the development of this plant, lead us to believe that beets were first grown in Asia (Assyria and Babylon) some 1,500 to 2,000 years before our era. Here, on the territory of Asia Minor and Syria (including the mountainous regions of ancient Armenia, in the vicinity of the river Van and the valleys of Northern Mesopotamia (along the rivers Tigris and Euphrates), wild forms of beets abounded particularly. There are reasons to believe that here the wild type of Beta vulgaris L. was first selected from among weeds for cultivation, since this species is distinguished by its high productivity, (compared to other forms of wild beets) and a greater need of moisture. Greater demands of food and water were responsible for its growth in close proximity to habitats, the gardens and fields of ancient, irrigated agriculture where its fertility and the bitter-sweet taste of its leaves and roots attracted the attention of the first agriculturists settled on the shores of Tigris and Euphrates. The selection of this beet for cultivation was prompted by the fact that, contrary to other wild species of beets, roots of Beta vulgaris L. were not deeply set and the plant completed its vegetative cycle in two years.

Leaves of beets were at first alone used as food; (in Asia leaves of wild beets are still used in salads). Sugar beet roots were grown later, in the VII and V centuries before our era (BC), in the period of Persian rule. Between the X and VIII centuries BC, Phoenicians and

Greeks imported leaf beets from Syria and Babylon into Southern Europe, to Sicily and Greece; later they were introduced to Rome. In the Roman era leaf beets were brought to France, Spain, Switzerland and other European countries.

In the process of cultivating wild sugar beets and taking into consideration their natural hybridization (imported and wild Western-European forms), and the transformation of plants, resulting from changes in cultural conditions, the best and most productive specimens were selected. Neverthelеss, Western Europe produced for a long time (up to the XIII century AC) only leaf beets. Beet roots were, however, known as a common "market plant" already in the VIII century AC, in Byzantium. The introduction of beet root forms, not only in some Asiatic countries but in Central Asia and Siberia, belongs to the same earlier period. Somewhat later, between the X and XI centuries, beet roots were carried along the waterways of commerce, the Black Sea and Dnepr river routs, into the "Kiev Rus'", as a result of the latter's trade with Byzantium, and from there into Poland and Lithuania.

Upon the conquest of Eastern markets by European traders, in the period following the Crusades, (XIII to XIV centuries), beet roots were imported from the Levant into Western Europe.

As a result of the joint production of leaf and beet roots and extensive selection (XIV toXVII centuries) new hybrid forms of beets were produced. At the start of industrial beet planting in Western Europe (XVIII century) basic forms of leaf beets (mangolds) were obtained from this diverse population together with hybrid beets (leaf and root beets) which produced the primary form of sugar beets, the Silesian beet.

By the end of the XIX century, the development of husbandry stimulated forage beet production which was succeeded by the production of garden varieties of beets. A chart (p. 18) indicates the origin of the cultivated sugar beet (ill. 2). Industrial production of sugar beets developed from the discovery of cane sugar in its roots. Search for new sources of sugar and its discovery in roots of beets were connected with the price of sugar obtained from cane, particularly price rises in countries which had a monopoly on the crop at the time (France and England).

The first research in Russia directed to obtain sugar from beets is traced to the end of the XVIII century. In 1799 Bindheim Iakov, a pharmacist and instructor of "medical substance teaching" at the University of St. Petersburg, extracted sugar from beets; his article on "Tests and observations on the domestic preparation of sugar in Russia, specifically from beets "sveklovitsa" " was published in 1803. In 1800 a Russian law assigned land for beet cultivation and established a special "Teaching Plant for the training of people who know new methods for obtaining sugar from "sveklovitsa". In 1802 the first commercial sugar factory was built in Russia in the village of Aliab'evo, Tula gubernia. The second factory was constructed in Russia in 1809 at Briansk uezd, Orlov gubernia, and in the twenties of the XIX century several plants were already in operation at Moscow, Smolensk, Grodno, and Nizhegorod gubernii.

Somewhat later the cultivation of sugar beets spread southward, to the Ukraine and to Kursk and Voronezh gubernii.

Within 15-20 years from the date of the construction of the first factory in the Ukraine (Troshchianskii plant, Kiev gubernia, 1824), the number of plants had grown to 67.

Industrial beet planting developed rapidly in Kiev, Khar'kov, Poltava, Kamenets-Podol'sk, Chernigov, and other Ukrainian gubernii, and in Voronezh and Kursk gubernii. On a limited scale sugar beets were also grown in Tula, Tambov, and Riazan' gubernii.

In Western Europe the first experiments in sugar-beet industrial production were made in Germany. In 1747 Marggraf proved that beets contained sucrose, substances resembling cane sugar in chemical composition. A pupil of Marggraf, Achard, tested various forms of beets and selected the Silesian beet as containing the most sucrose. Organization of the production of sugar from beets followed (1799). In 1802 the first sugar factory was constructed in Germany. Results derived from the initial work with beets were soon used in France and later in other European countries.

Prior to the First World War (1914-1918), the principal European countries producing sugar from sugar beets were Russia, Germany, Czechoslovakia, France and Belgium. The total area of sugar beet plantings in all European countries was slightly above 2 million hectares, of which Russia possessed one-third, about 650,000 hectares (1913). Following the First World War sugar beet planting and sugar beet industry gained a foothold also in Sweden, England, Italy and Spain. Sugar industry was strongly developed in the same period in America (Argentine) and Asia (Manchuria).

Sugar beet industry in Tsarist Russia, as in other capitalist countries, was founded on the exploitation of the laboring classes. All profits from the cultivation of sugar beets belonged to sugar factories and landowners. To the majority of the population, including the multi-million peasant class, sugar was an almost prohibitive item.

Prospects for developing production and raising the level of sugar beet cultivation in our country were opened after the Great October Socialist Revolution, especially after the firm establishment of the collective farm structure. Collective farm sugar beet fields are provided by our industry with highly effective mineral fertilizers. The network (chain) of machine-tractor stations in regions of sugar beet planting serve the sugar beet industry, fulfilling with the aid of modern machinery and implements the principal heavy tasks in growing sugar beets, i.e. deep plowing, early cultivation of the soil before planting, care of plants, pest and disease control, harvesting. The socialist regime and the above measures introduced by the Soviet Government were responsible for the expansion of sugar beet areas to 1.225.3 thousand hectares (1940), i.e. almost double the planted area of sugar beets of Tsarist Russia. The proportion of sugar beet planted area in USSR, compared to capitalistic countries, grew simultaneously (before the Great National War the total area in all capitalistic countries in Europe and Northern America represented 1.873 thousand hectares).

Principal areas of sugar beet plantings (USSR) are located in the Ukraine (over 800.000 hectares), in Kursk, Voronezh, Tambov oblast(s), Krasnodar krai (where sugar beet plantings were particularly extended during Soviet rule).

Sugar beets are grown on smaller areas in Orlov, Tula, Riazan' and other oblast(s). The most important achievement in Soviet sugar beet cultivation is the introduction of this valuable crop into new regions, where it never had grown before. Kirgiz, Kazakstan, Georgia, Armenia SSR, the Far East, Western Siberia, (Altai krai) belong to these. Planting of sugar beets is spread also on the Volga (Kuibishev and Saratov oblast(s)) and in other central and northern regions. During the Great National War, sugar beets were also grown in Uzbekistan, and still later, in the Baltic republics, Lithuania and Latvia.

At present sugar beets are widely introduced into central and northern non-chernozem regions of USSR. The field station of Timiriazev Agricultural Academy yields 500-600 c/h of sugar beets (I. V. Iakushkin).

High yields of sugar beets are also obtained north of Moscow, in Vologda and other oblast(s).

Thus the geographical boundaries of cultivating sugar beets have been widely extended: in the north beyond 57^{0} n.lat., in the south to 40^{0} n. lat. (Tbilisi, Leninakan) and, as seen from the listing of new regions in sugar beet planting, far out to the East.

Collective farmers and laborers of state farms of new regions have mastered the art of cultivating and attaining high yields in sugar beets. Science has contributed its share; new varieties of sugar beets adapted to local conditions, resistant to frosts and Cercospora, etc., have been produced in new regions in Siberia and other northern regions, on irrigated lands of Central Asia and Kazakstan.

New methods for growing sugar beets in eastern drought-, non-irrigated regions and in the north are being studied; methods have been devised for the safe storage of the raw product in extreme southern regions of sugar beet cultivation.

Simultaneously with the widening of geographic boundaries and areas in sugar beet production the general level in yield and sugar content was raised. The successful development of the Soviet sugar beet industry is further noted for having served as the beginning of the Stakhanov movement in agriculture.

In 1934 a unit (link) headed by M. Demchenko, collective farm "Komintern", Kiev oblast', harvested 406 c/h of sugar beets. Her promise given to comrade Stalin at the Second All-Union Conference of collective Farmers to produce a yield of 500 c/h in 1935 was over-fulfilled; her yield was 523.7 c/h.

Stakhanov methods in sugar beet growing spread rapidly, the number of farmers aiming at top yields in sugar beets multiplied in all regions. In 1936 and succeeding years yields of sugar beets of 1.000 c/h were obtained by M. Pilipenko, Khar'kov obl., - 1.049 c/h; by Kh. Baidich and Androshchuk, Vinnitsa obl., - 1.036 and 1.028 c/h; V. Chalova, Kursk obl. - 1.037 c/h; N. Dadykina, Kursk obl. - 711 in 1936 and 1.054 c/h in 1937.

Even larger yields were obtained under irrigated conditions: In Kirgiz SSR - 1.000 and 1.320 c/h; in Kazakstan - 1.119 c/h.

High yields of sugar beets were obtained throughout the entire planting area. At the collective farm imeni Lenina, Kamenets-Podol'sk obl. the average yield gathered in 1937 - 1939 was 422.3 c/h. In Orinin region, same obl., the average was 320 c/h in 1939.

New regions of sugar beet planting, having mastered the technique of raising the crop, produce equally high yields. The highest were obtained on irrigated lands in Kirgiz SSR, Kazakstan, Georgian SSR. Thus in Kirgiz SSR growers succeeded in raising an average yield of 300 c/h throughout the entire planting area.

Advanced sugar beet farms, aided by science, contributed new methods to the production and cultivation of sugar beets. Applying the system of cultural treatment and enriching it by new, improved measures, they raised the productivity of the plant and demonstrated that there is no limit to fertility in socialist production.

Sugar beet growing suffered exceptional losses from Fascist invaders in the years of the Great National War. Liberation and transfer to peaceful reconstruction was accompanied by the struggle for high agricultural levels and high and stable yields, which included sugar beets. Several sugar beet growers deserve particular mention in this connection, all decorated heroes of Socialist Labor. E. Dikhtiar', collective farm imeni Shevchenko, Shpoliansk region, Kiev obl., who gathered in 1947, 653 c/h on a plot of 2.4 hectares. A. Chernykh, coll. farm "Novye rel'sy", Panin region, Voronezh obl., 707.5 c/h from a plot of 2 hectares in the same year. E. Baskakova, coll. farm "Progress", Dobrinsk region, Voronezh obl., - average yield of 868.5 c/h from plot of 4.2 hectares. S. Nagibaeva, coll. farm "Djan Talap", Kazak SSR, raised 808 c/h from a plot of hectares (irrigated land).

USSR set a world record in sugar beet yield in 1949: O. K. Gonazhenko, decorated Hero of Socialist Labor, a link member of the collective farm "First of May", Talda-Kurgan region, Kazak SSR, raised 1.515 c/h of sugar beets on 2 hectares of land. The number of sugar beet growers, Heroes of Socialist Labor, decorated with orders and medals of USSR, is increasing each year.

High yields on large areas represents the aim in the creative efforts of Soviet advanced sugar beet growers, collective farms and Soviet agronomists.

USSR occupies first place in the world in sugar production from sugar beets. The old sugar factories have been completely reconstructed under Soviet rule. Many new plants have been built, including those of new regions of sugar beet growing; where output has been increased. The season has been lengthened at these factories. Thus in 1913-14, the average season at sugar beet factories lasted 78.8 days a year; in 1937-8 - 141.2 days.

Scientific research institutes (Kiev, Moscow) and the chain of experiment stations and base points developed and introduced into production more effective measures for cultivating sugar beets, with regard to soil cultivation, fertilization, preparation of seeds, additional plant feeding, proper storing methods, all intended to reduce losses, in addition to technological improvements in processing and lengthening the period of production (to 240 days).

The fertility of sugar beets, as a sugar bearing plant, depends upon the weight of its roots per unit area and its sugar content, which all determine the amount of yield of sugar per hectare. Varieties of sugar beets of Soviet selection produce very high yields of sugar per hectare. Advanced sugar beet growers succeed in gaining 150 c/h and on plots of record harvests, 230-250 centners.

Further introduction of new scientific and practical achievements into ~~the~~ practical sugar beet growing will raise the level still higher.

End of chapter.

Karpenko, P.V. Transl. 111
Sveklovodstvo; Sugar Beet Cultivation
Moscow, 1950 66.K143

Chapter XVI. (p. 230-240)

PRINCIPLES OF SELECTION IN SUGAR BEETS

The principal task in sugar beet selection is to introduce new, more productive varieties. In the process of the work the very methods of producing varieties are improved and new, superior methods created. Certified varieties of sugar beets must be of high yield in weight of roots, possess high sugar content, good quality sap and a minimum amount of non-sugars. In addition, sugar beet varieties must not flower and be adapted to prolonged storing (disease-resistance, particularly to storage rot).

The belief prevailed that the same sugar beet varieties are adapted to various regions, i.e. that a variety produced at one selection station may suit any other region equally well (in the East, South, etc.)

Soviet agro-biological science and the practical knowledge of collective farmers have rejected this view. Sugar beet varieties differ considerably in their response to external environments (soil, climate). Certified varieties of sugar beets produce higher yields in locations where they are produced or in sections closest to the same natural conditions.

The principal indicators of the evaluation of sugar beet varieties are their sugar content, weight of roots and amount of sugar per plot unit, (amount of sugar in centners per hectare, estimated according to weight of roots and percentage of sugar). Sugar beet varieties are also characterized by the amount of total and harmful nitrogen, ashes, quality of sap, resistance to fungi and bacterial diseases, capacity for prolonged storing.

In producing varieties the conditions contributing to their growth and development of plants in a certain location should be carefully considered; in other words, beet selection and training of progeny should be directed in accordance with local conditions. Only in such case is the production of highly productive varieties for definite oblast(s), regions, farms, possible. Thus Siberia requires varieties which are not only producing high yields in roots, have adequate sugar content and are resistant to prolonged storing, but the location calls for varieties distinguished by rapid development and growth, capable of reaching technical maturity in a brief vegetative period, i.e. high indicators of root weight and sugar content. For regions of Kazakstan and Kirgiz SSR varieties responding to irrigation are essential, those using irrigation waters productively and adjusting well to a partial salinity of the soil. Demands placed upon sugar beet variety are consequently manifold and, depending upon the respective regions crops, develop differently in every section. Selection adhering to such practices conform to the progressive agrobiological theories of I.V. Michurin and T.D. Lysenko.

HISTORY OF SELECTION OF SUGAR BEETS

Selection of sugar beets, the cultivation of which is younger than that of many other field plants (150 years), has its own history.

In the first period of sugar beet selection, at the beginning of its cultivation, selection was made of the best specimens, in shape of root, coloring and other morphological traits. This method resulted not only in increase in yield in a relatively short time, but in attaining a sugar content of 5-6%. The latter was also increased by selecting roots according to their gravity volume (weight)(in saline solutions of different concentration).

Beginning 1856 a new method in sugar beet selection for sugar content was introduced, according to evaluation of progeny (Vilmoren). A polarimeter was used to determine sugar content, at first to determine sugar in sap, next in vegetable pulp.

The sugar beet selection method, according to evaluation of progeny proved very successful: the sugar content in beets increased rapidly. Already in 1858 - 1868 it reached 10-11%, in 1888 - 13.5 - 13.7%; in 1898 - 15.2%; in 1908 - 18%, and in 1912 - 18.5%. Simultaneously with the production of varieties of beets of high sugar content ~~went~~ proceeded work on selection for yield. Thus sugar beet selection was guided into two directions: selection for increasing the content of sugar in the root and selection for increasing the weight of roots.

In our country after the Great October Revolution, sugar beet selection achieved remarkable results in a relatively short time; they involved the production of varieties of large weight roots, and high sugar content, in addition to many other positive characteristics.

In contrast to the analytical one-sided selection characterizing past sugar beet selection methods, Soviet selectors applied a complex method for the total sum of economic characteristics, taking into consideration conditions of external environment in respective regions of cultivation. This method was first used by I. V. Iakushkin at Ramona Selection Station. It provided the opportunity for many-sided improvements of sugar beets and creation of varieties of high grade.

If in the past, in Tsarist Russia, rejuvenation of mother seeds of sugar beets was primarily achieved at the expense of Western European varieties, all areas were in the Soviet period planted exclusively with seeds of domestic selection, produced by the chain of selection stations, established under different soil-climatic conditions of zones of sugar beet growing.

METHODS OF SELECTION OF SUGAR BEETS

The most important condition in successful selection of sugar beets is uninterrupted selection obtained by cross pollination; repeated reproductions (without segregation) of seeds of sugar beets are frequently lowering the grade and quality of yields.

Let us dwell upon the most important methods of sugar beet selection.

MASS SEGREGATION is theoretically based on the gradual segregation of roots of beets of desirable characteristics and the simultaneous rejection of roots not possessing them.

Mass segregation was widely used in the past and has to a certain extent not lost its significance even now. Its essence consists in that only one or two or several of the best sugar beet varieties are planted in a field and that during harvesting best specimens are selected of the entire mass of roots, their weight and sugar content established, i.e. those so-called plus variants segregated, that exceed average indicators of the best standard varieties. Depending upon the quantity and quality of the material and features demanded of seed stock, 5 to 10% of these super-elite roots are chosen for further varietal work and 20-40% set apart for mother seed elite. Of these mother seeds are grown and their reproduction provides industrial seeds. The inadequacy of this method of segregation is in the lack of evaluation of best individual progenies, the uncertainty concerning the selected material and the slow improvement of varieties.

INDIVIDUAL SEGREGATION was introduced into practical selection in the middle of the XIX century. The method gained wide popularity and almost universal recognition in the past 2-3 decades. It consists in that from the total mass of roots only a small amount of root-ancestors, altogether 0.1-0.5%, are selected (according to laboratory and field indications) that meet all standards set for the particular variety (in root weight, percentage of sugar, form, etc.).

Root-ancestors and seeds are planted and harvested separately from every plant. The genera obtained from seeds of root-ancestors are examined separately in comparable plantings and selective tests and the genera chosen which in some degree retain best the standards established for selection. The usual method of comparison was widely applied for this purpose. Standard seeds are planted together with numbered future varieties of beets (every 3-5 plots); the best (subject to selection) are considered those which produce the essential characteristics (root weight, sugar content, etc.) above the standard; from among the best number of selected genera new varieties are formed.

Individual selection provides the opportunity for a deeper study of the biological characteristics of individual genera, aimed at directing their crossing towards creating desirable conditions for their production. At Krasnodar krai we achieved considerable success in a relatively brief period by using this method to improve the quality of a variety and gain a drastic increase in sugar output (5 kg. per 4.5 from one centner of beets.) Plant pollination must be controlled in individual selection in order to obtain desired crossings and the necessary combination of previously studied paternal and maternal plants.

Every root-ancestor is planted for this purpose where surrounded by selected pollinators (pollinators are always used in largerquanties than pollinated plants). Occasionally one pollinator is used for all plants. Thus well-studied super-elite, a clone or mixture of clones may serve as pollinators.

Selection of pollinators is made by testing several pollinators for the same ancestor. Ancestors and pollinators are "cloned" (kloniruiut) for this purpose and ancestor clones are planted on several isolated plots, each with one pollinator. In order to avoid direct pollination between plant ancestors, resembling each other in their characteristics, as well as to prevent the carrying over of the pollen of other varieties of beets, groups of roots are planted in fields occupied by high-stemmed plants of dense grass stand, such as winter rye, in intervals between planted groups of roots (clumps) at 200-250 m. (Ramona Selection Sta.).

In regulating pollination in sugar beets it is not necessary to resort to isolation of plants. Repeated pollination of plants selected for crossing should proceed freely, at close planting of crossed plants, under the most favorable environmental conditions of bloom and development of balls, of crossing plants (clumps). Isolation of different varieties of sugar beets is nevertheless imperative in seed growing, as stated above in the chapter on "Biology of Sugar Beet."

A large number of desirable combinations of crossed pairs in individual selection and a large amount of seeds will result from vegetative propagation. This method provided for 40-60 new roots from one root ancestor, almost identical with the latter in quality and characteristics. Roots propagated vegetatively are planted in the spring of the following year in separate clumps (clones) together with other roots that were vegetatively propagated.

The fault in vegetative propagation of sugar beets lies in the lengthening of the cycle of plant development which naturally prolongs the entire selection period. We succeeded, however, in obtaining good results from vegetative propagation for subsequent crossings. Thus at Pervo-Maisk Station races of beets were obtained in this manner, resistant to Cercospore, of higher sugar content, one-seeded bolls, etc.

Occasionally the GROUP METHOD OF SELECTION is used, an intermediate method between mass and individual. Root-ancestors are divided before planting into groups according to separate characteristics relating to weight, sugar content, etc. This method is expedient because it ensures the possibility of wider cross pollination and greater endowment of inherited characteristics of a variety.

Both individual and group selection are mutually supplementing each other in practical selection, producing a sort of new method - "individual group." Its outstanding feature is the union of products of individual selection at a certain stage of the work into one group of close or selected characteristics of the progeny for the production of satisfactory future varieties.

Soviet agro-biological science, based on the teachings of I. V. Michurin and T. D. Lysenko, has created new selection methods which allow control of the nature of plants and the production of new varieties possessing useful, previously decided upon characteristics.

Michurin arrived at the conclusion that interference by man will compel every animal and vegetable form to transform rapidly in a direction desirable to man. It is however necessary to know the laws of these transformations to achieve this. Michurin agro-biological theory teaches that the organism and the necessary environment for its survival represent a unity; that heredity is the capacity of a living body to require definite conditions for its living, development, and to react firmly to any conditions (T. D. Lysenko).

A plant growing under conditions that conform to its heredity develops in the same manner as it did in preceding generations. This plant may, however, be placed in conditions not conforming to its heredity, and will, in such case, be compelled to assimilate conditions of an external environment foreign to its nature in some degree or other. This leads to its developing traits that differ from preceding generations. The reason for the transformation of a plant or some of its parts is the transformation of the type of assimilation, the type of metabolism.

The development of different cells in the same plant, of different cell parts, of some processes, requires different conditions from an external environment. By altering conditions it is possible to obtain considerable results in practical selection. An example may be found in the transformation of summer wheat into winter wheat and winter crops into summer crops.

It is also known, however, that in shedding its old, established hereditary charactéristics the plant does not fix new hereditary traits at once.

According to Michurin, an organism of plastic nature, of shattered heredity, is secured as a result of changed external conditions. Conservative heredity is weakened or eliminated in those plants, and so is the selectivity with regard to external conditions. In place of conservative heredity, the tendency to prefer some (new) conditions to others is preserved or reappears among such plants. Plants of shattered heredity may be trained under different conditions (of development) which in the final result lead to the acquisition of desirable organisms, i.e. varieties of one or another plant. Michurin agrobiology teaches how it is possible to shatter the hereditary nature of a plant, i.e.:

1. By grafting, i.e. growing together tissues of different genera ("poroda");
2. By the influence of an external environment at definite moments of the passing of the organism through various processes of development;
3. By crossing, especially of forms drastically differing in habitat or origin; in forming (producing) new varieties of sugar beet crossing (hybridization) is applied as a rule.

Crossings are of the a) intra-varietal kind which follow differences in biological characteristics, response to individual methods in agrotechnique, kinds of fertilizers, etc., and the direction taken in selection; b) inter-varietal to strengthen economically useful characteristics or obtain new varieties more rapidly (use of heterosis); c) intra-species - crossings of sugar beets with garden forage and other forms of beets.

In selecting parent pairs for crossings it is necessary to disclose the hidden possibilities of hereditary origin. These hidden possibilities may be found in ancestors on condition that every parent is artificially provided with conditions necessary for its stage development which lack in field conditions of the crop's region.

Thus some plants are vernalized, others are provided with favorable conditions for passing through the light stage. These two groups of plants will develop their own different cycles in new conditions. It will provide the opportunity to foretell the nature of development of these plants under different environmental conditions.

In this manner are established "narrow spots" in the hereditary origin typical in each parent and in definite surroundings which permits the deliberate production of a hybrid in the future, one eliminating (by compulsion) both "narrow spots."

The experiments made at Ramona Selection Station may serve as an example for similar selections of parental pairs to produce varieties of sugar beets. Here were made selections from initial (original) sugar beets planted on extensive fields. Under these conditions beets responded to improved nutritions (chiefly nitrogen) combined with improved use of moisture, light and air.

In distinguishing between the density of placement of plants in a row (45 x 40 cm and 45 x 20 cm) the plants were studied according to their biological characteristics and selection was made of those plants which differed in their response to conditions of growth.

In a dry year some plants showed high vigor (energy) of initial root and leaf formation in areas of nutrition of 45 x 20 cm and developed poorly when grown on 45 x 40 cm. These plants and their progeny proved, following checks to be the most productive in regions of inadequate moisture and relatively brief vegetation periods. Other plants, however, stood out by their exceptional vigor during initial root and leaf formation and occupied first place in yield when grown on plots of 45 x 40 cm, while their development was poorer on plots of 45 x 20 cm, their yields proving lower. Such plants and their progeny proved best under conditions of adequate moisture. Plants producing in dry years high yields and sugar contents on both size plots (45 x 20 and 45 x 40 cm) may serve as initial material for creating varieties adapted to different ecological surroundings.

The sugar beet variety B-1537 (A. L. Maslumov) was produced in exactly this manner. It was obtained as a result of the crossing of three previously studied components, of which two (80% of seeds) were trained under conditions of dense plantings, and the third (20% of seeds) grown under less dense conditions.

In selecting parental pairs it is advisable to use wide initial material as much as possible, and to select ancestors that carried the sum of positive characteristics within themselves, not similar but different, in order that "narrow spots" be eliminated in the development of the progeny. In creating hybrids from previously selected parental pairs it is possible to foretell even before crossing the development of possibilities in hereditary influence. These forecasts may refer to the stage analysis of plants selected for crossing, which should precede hybridization.

Of enormous significance in obtaining desirable varieties is not only the proper selection of parental pairs but the training of hybrids (sexual and vegetative). No hybridization will produce positive results if conditions are not created that will contribute to the development of THOSE CHARACTERISTICS THE INHERITANCE OF WHICH IS DESIRED IN THE VARIETY UNDER PRODUCTION. (I. V. Michurin)

He wrote concerning it that the quality of every hybrid grown from the seeds of a fruit obtained from the crossing of two parents consists in the combination of only that part of characteristics which is transferred by heredity from plant-ancestors (i.e. paternal, maternal and their relatives), the development of which was favored by conditions of external environment at the EARLIEST STAGE OF HYBRID GROWTH.

In selecting parental pairs differences in the environmental conditions of both parents may have positive influence. The principle of distant hybridization dates back to this circumstance. In this case it is necessary to always consider (in selecting plants for crossing) their biological requirements formed through generations and to visualize in advance how the development of the hereditary element under other conditions and definite factors of influence may proceed.

It is essential to create conditions that contribute to the domination of useful characteristics, to foresee in advance the entire course of contrasting development of hereditary foundation in a desirable direction.

Practical selection of sugar beets obtained in the teachings of I. V. Michurin and T. D. Lysenko provided new, wide possibilities for directed varietal formation. Principles of the work have not yet been firmly established, but where the work is conducted on the basis of progressive biological science large successes have been secured. As an example of a successful selection of sugar beet one may cite the work of Ramona Selection Sta. (A. L. Mazlumov), where for the past 10 years such highly productive varieties of sugar beets have been produced as: R-1537, R-47, R-306, R-407, etc. The study of available varieties and the large variety of uncultivated forms of sugar beets permit the extension of directed hybridization aimed at obtaining high yields, better resistance to diseases, higher sugar contents. It is expedient to apply widely vegetative hybridization in this connection, especially considering that sugar beets cross vegetatively easily with other species, as proved by T. D. Lysenko in 1922.

The fact that notices appeared in foreign literature concerning a standstill in sugar beet selection deserves mention. They are connected in part with the assumption of physiological limitations in sugar accumulation in beets, partly with the belief of the impossibility of combining high yield with high sugar content in one variety.

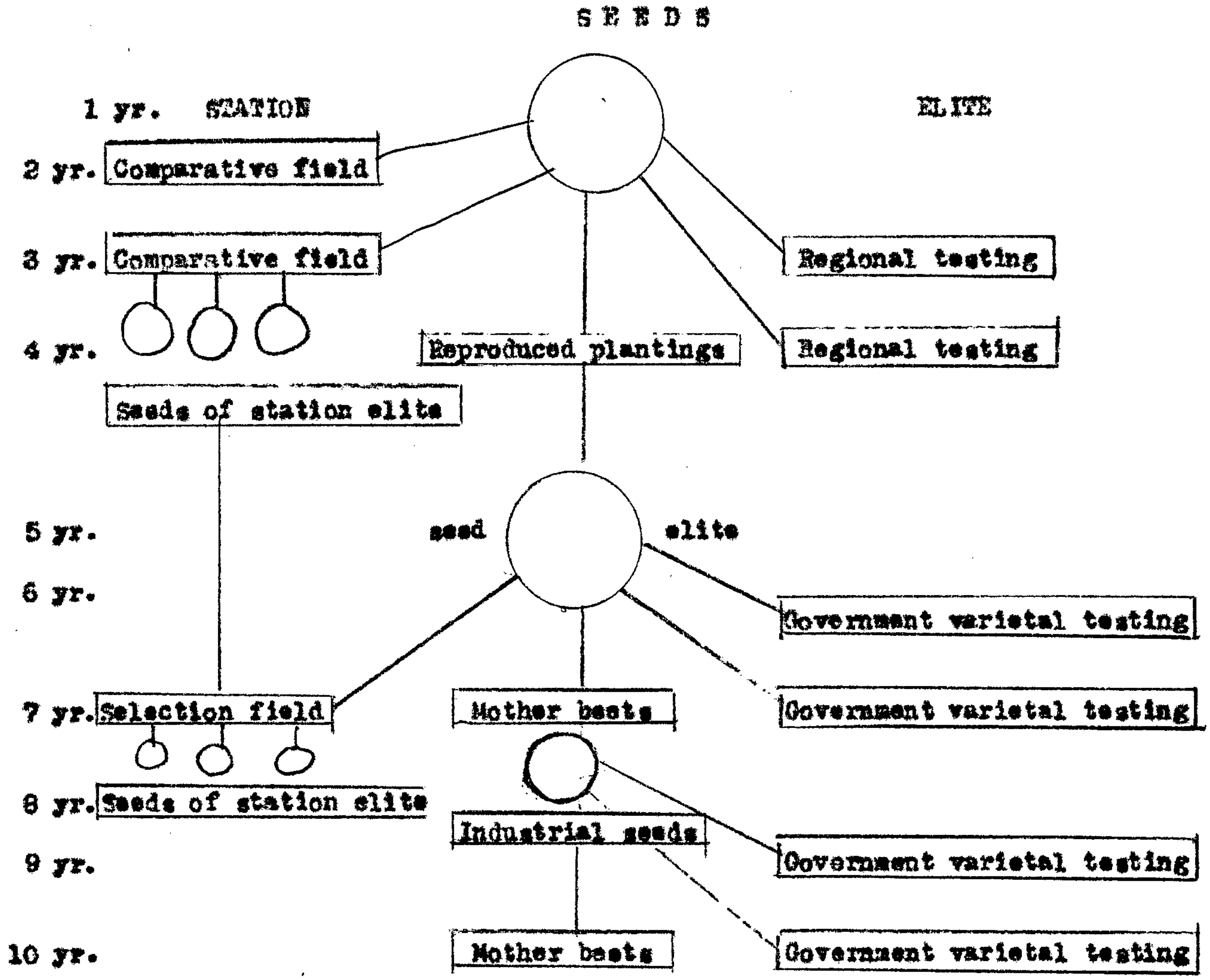
Soviet agrobiological science, having "creatively developed" the Darwin theory, has proved in practice the irrelevance of these statements and pointed the way to the production of varieties of high yields and superior sugar content and other useful characteristics required in industry for diverse natural conditions.

The root weight of beets and their sugar content, as obtained at Ramona Selection Sta., (R-1537 and R-306), as well as in varieties of L'gov and Verkhniachesk Stations, grow in free correlation, not appearing as physiological antagonists.

Ill. 51 presents the general scheme of selection-seed growing work on sugar beets. It shows that elite seeds are obtained from stocks of a selection field (by segregating "ancestors" and super-elite). Seeds of station elite already studied on experimental fields having successfully passed regional varietal testing (1-2 yrs.) are introduced as new varieties for propagation (reproduction plantings). Transplantings from reproduced plantings produce elite seeds which undergo government varietal testing (also for 1-2 yrs.). If the new variety receives a high rating in government varietal testing the elite seed is passed on to industry, i.e. the state farms of Glavsakhar, for mother seed plantings. In the following year industrial seeds are obtained from roots of mother beets intended for fields of collective and state farms. One part of industrial fields is left for government varietal testing and if a variety is highly rated its industrial seeds are once more passed on to industry for mother seed production. The industrial value of a variety is considerably heightened in such case since industrial seeds are always ten times more plentiful than elite seeds.

End of chapter.

ILLUSTRATION 51



General scheme of selection and seed growing of sugar beets.

(End of chapter)

Karpenko, P.V. Transl. 111
Sveklovodstvo; Sugar Beet Cultivation
Moscow, 1950 66.K143

Chapter XIX. (p. 269-289)

PROTECTION OF SUGAR BEETS FROM PESTS AND DISEASES

Sugar beets are infested by many pests and diseases during growth and storing. Yields may be drastically reduced if pest and disease control is inadequate.

Among sugar beet pests insects are the most numerous and cause greatest injury. Some insects - chewing - are equipped with mouth parts leading themselves to chewing foliage, stems and roots of plants. Weevils, caterpillars of the sugar beet webworm, cutworm moths, and many others belong to these.

Other insects - sucking - possess mouth parts adapted for piercing the epidermis of plants and sucking the sap from them. Among these are aphids, flea bugs ("Klopy"), etc.

Inducers of diseases of sugar beets are chiefly micro-organisms, fungi and bacteria. The bodies of fungi consist of the thinnest threads, usually not perceptible to the naked eye (hyphae of fungi) which in coalescing produce mycelium. By piercing the plant tissues the fungus destroys them and extracts the nutritious substances it wants. The surface of the injured plant exhibits in some cases moldy films, in others, spots of various color, form and size.

Fungi propagate by spores (conidia) which are distributed by wind, rain or insects. Having attacked the plant, the spore grows under favorable conditions; in the process fungi excrete special enzymes which split complex organic substances and create favorable conditions for the development of fungi. In addition to bearing fruit in the summer, fungi also bear fruit in the winter - oospores, zygospores, ascospores, all extremely resistant to fall and winter weather conditions; spores overwinter easily and are preserved until the next harvest.

Another group of diseases - bacterial - is caused by bacteria. These penetrate the plant tissue through apertures in leaves or spots of mechanical injuries (wounds, cuts) or obstructions caused to surface tissue by fungi and other means. Propagating rapidly in plant tissues, bacteria excrete toxins, poisonous products of their life's activity, capable of destroying plant tissue.

Plant diseases of sugar beets are also caused by viruses. Virus diseases are frequently spread through the sap of diseased plants and transferred from one plant to another by sucking insects.

Finally, plant diseases are frequently the result of a disturbance of their normal physiological activity (lack of separate nutritious elements in the soil, lack of moisture, air, etc.).

It is necessary to point out that not only these (physiological) but also the rest of the above-mentioned sugar beet diseases appear more frequently and severely on fields where the soil lacks adequate nutrition or possesses poor physical properties, i.e. excessively moist, cold, poorly aerated soils. Root diseases of beets (tail? rot, brown rot, root eater, etc.) are equally the result of weakened and wilted roots.

Pests and diseases of sugar beets reduce yields of roots, sugar content, generally spoil the quality of beets as a raw material for processing and reduce beet resistance during storing. Many diseases of sugar beets produce, in addition, branching of roots which leads to yield losses in digging and cleaning.

A large number of insects and inducers of diseases perish of conditions unfavorable for their development; some species of insects propagate, for instance, only in hot and dry summers. To depend upon the natural death of insects and disease inducers is, nevertheless, not possible. It is imperative to control them by applying cultural treatment and special control methods (chemical, mechanical and biological).

METHODS FOR CONTROLLING PESTS AND DISEASES OF SUGAR BEETS

Methods for controlling pest and diseases of plants, although very effective, will produce safe results only in cases when applied systematically and not sporadically. This means that pest and disease control must proceed in a definite sequence and inter-relation of methods of control, and at the same time be closely connected with the entire field growing system, i.e. be applied to all fields under crop rotation and taken into consideration plant varieties resistant to pests and diseases.

The opportunity to achieve similar active pest and disease control belongs only to our planned socialist production.

Pest and disease control of plants presupposes: 1. Establishment of conditions contributing to better growth and development of plants (specifically sugar beets as a crop severely infested by pests and diseases), many of which are specific; 2. Establishment of conditions that interfere with the development and spread of pests and diseases and the destruction of foci of infection in fields and on plants; 3. Destruction of pests and inducers of diseases by chemical, mechanical and other methods; 4. Improvement of sanitary conditions of seeds infested by pests and diseases, soil, seed stock, containers, equipment, etc.

A large place in pest and disease control should be assigned to prophylactic care, i.e. preventive control. An essential element in pest and disease control is also the fulfillment of required regulations throughout the vegetative period of sugar beets and other crops under rotation, as well as during harvesting and storing.

Pest and disease control of plants can be of agro-technical, chemical, mechanical and biological type.

Proper grass-field crop rotation is the basis for agro-technical measures of control and represents simultaneously the most important condition for the successful execution of other measures. Proper distribution of crops in rotation, that takes into consideration degree of injury, may prevent the propagation of many species of pests and diseases and contribute to the sanitation of infested soils. Improper distribution of crops in rotation, such as close succession of plants susceptible to identical pests and diseases or their planting in closely adjoining fields in certain years, will contribute to the development of diseases and pests. Thus it is not permissible to plant oats after sugar beets on soils infested by nematodes.

Among the individual agro-technical methods in pest and disease control in crop rotation with sugar beets the following are of major significance:

1. Timely disking and deep fall plowing; the latter carries larvae and pupae of insects to the surface of the soil where they are exposed to the unfavorable effects of the weather (cold) or are picked by birds; another part of pupae and larvae reaches such depths under deep plowing that cause their destruction. Simultaneously with vegetative residues, which are plowed under and decay, inducers of various diseases of plants are destroyed.

2. Planting of healthy seeds, non-infested by disease, and planting of healthy, non-rotting root-seeds capable of producing healthy seedlings and subsequently well-developed mature plants.

3. Better periods for planting sugar beets, other crops and seed plots; sugar beets should be planted and seedlings transplanted early; this ensures early sprouts which have time to gain strength and are able to resist pests and diseases;

4. Proper care of plants; this equally contributes to better plant growth and increases their resistance to pests and diseases. Cultivating between rows during the period of pupating of insects (wireworms, etc.) is particularly effective and causes their destruction; no less importand is weed destruction, especially if one considers that many pests and diseases (webworm, cutworm moth, etc.) transfer to plantings of industrial beets;

5. Removal of cut and pulled weeds from fields after weeding and harvesting, especially from sugar beet crops. This prevents the spread of pests and diseases which frequently are retained in vegetative residue during the winter.

6. Weed destruction on waste lands, boundaries of roadways, because these serve as foci of infection; weeds must be cut before blooming to prevent self-sowing.

BIOLOGICAL CONTROL MEASURES against pests and diseases use natural enemies of both. Among them are local, predatory insects. Other predacious insects are acclimatized and used in certain locations for the same purpose. To these belong parasite-egg-eaters, propagated in laboratories and let out into fields. They lay their eggs into the eggs of insect-pests and develop within them. Among these parasite-egg-eaters trichogramma is widely known in practical agriculture and is applied in the control of sugar beet webworms, cutworm moths and other pests.

Of considerable significance in biological measures of control are various insect-eating birds (starlings, etc.) which destroy harmful insects in large quantities.

These useful birds should be protected and helped to nest.

Upon the suggestion of T. D. Lysenko, chickens are used extensively on beet fields since they devour sugar beet weevils, caterpillars of the sugar beet webworm, cutworm moths, may beetles, etc.

CHEMICAL MEASURES OF CONTROL consist in spraying and dusting of plants and the application of poisonous attractants (against chewing caterpillars).

Insecticides applied against pests are divided into two groups: poisons of internal action or intestinal poisons; poisons of external action, or contact poisons. Poisons that control diseases are called fungicides.

Intestinal poisons are applied against chewing insects. Upon penetrating into the intestines of an insect poisons kill them. Contact poisons are applied against sucking insects. These poisons injure pests by penetrating into their bodies through epidermis or respiratory organs and by clogging respiratory openings.

Application of fungicides is limited to the surface of leaves and other parts of plants which they cover with a thin layer of poisonous substance intended to paralyze the development of fungi and bacteria.

Chemical methods of control of pests and diseases are conducted by specially trained personnel under the supervision of agronomists-specialists (entomologists and phytopathologists) and by observing all precautionary measures in handling, transportation, storing and use of poisons. These precautionary measures are described in special instructions which must be observed.

MECHANICAL METHODS of control are in the majority of cases supplementing chemical and other control methods.

Mechanical control methods consist in collecting and destroying pests. Thus butterflies of the webworm and sugar beet leaf bug "Klop," etc., are caught in gauze nets or special caterpillar nets. Occasionally fields after plowing have poisoned attractants distributed in trenches against caterpillars. Many other mechanical means for the control of pests are used besides.

The aviation method has gained large significance and wide application in the USSR as a method of controlling agricultural pests and diseases. Airplanes specially adapted for that purpose are used to spray and dust poisonous chemical substances or to distribute poisonous attractants upon infested areas from a height of 5-10 m. The following substances are applied to treat sugar beet fields: dusting with sodium fluoride (8 kg/h) against weevils; spraying against the same pest with barium chloride (10 kg/h to 50 liters of water) and sodium fluoride (3.5 kg/h to 50 liters of water); dusting against sugar beet flea beetle with sodium fluoride (8 kg/h), 12% hexachloran (6-8 kg/h) or DDT (12 kg/h).

The aviation method proves highly expedient; 80 hectares of sugar beet fields can be dusted and 20-30 hectares sprayed in one hour.

We list below the most important control methods which are specially designed for individual species of pests and diseases of sugar beets. A brief description of these pests and diseases and their biological characteristics is provided.

<u>PESTS OF SUGAR BEETS AND METHODS FOR THEIR CONTROL</u> (p. 274-288)

Common sugar beet weevil <u>Bothynoderes punctiventris</u> Germ.) Sveklovichnyi dolgonosik obyknovennyi. See: Briantsev, tr.180a, p. 62-67.

Grey sugar beet weevil (<u>Tanymecus palliatus</u> Fabr.), "seryi sveklovichnyi dolgonosik".

Striped weevil (<u>Chromoderus fasciatus</u> Müll.); "Polosatyi dolgonosik"; its larvae do not dwell in the soil but between the roots of beets. Lays its eggs on young rootlets close to the root neck. Injured young plants (stage of 1-2 pairs of leaves) wilt and may dry. Pupating takes place towards the end of July, beetles appear in August. Methods of control are the same as for common beetle.

Sugar beet flea beetle (<u>Chaetocnema breviouscuola</u> Fald.), "sveklovichnaiia blokha." See: Briantsev, tr. 180a, p. 68-69.

Sugar beet webworm, (<u>Loxostege sticticalis</u> L.); "Lugovoi motylek"; See: Pivovarov, tr. 190, p. 1-26 and Dereviancbenko, tr. 120, p. 1-13.

Cutworm moth, (<u>Euxoa Segetum</u> Schiff), "ozimaiia sovka"; (p. 281).

Leaf-eating moths. Caterpillars of leaf-eating moths leave only large veins of outside leaves unharmed, destroying central leaves completely. Among them are: Borers (<u>Phytometra gamma</u> L.), "sovka gamma"; cabbage, alfalfa, sweet clover, smart weed gamma, etc. These moths resemble the cutworm moth in appearance but have their own characteristic as species. Front wings are dark colored with typical designs in different species. They fly when dusk falls (sovka gamma flies also during the day) and lay their eggs on the lower surface of leaves. Their caterpillars also differ in coloring; the pests lead a semi-daylight existence, injure plants directly and are multi-poisonous; pupate frequently in upper soil layers. Pupae overwinter primarily and develop the first generation of butterflies in May or June. The majority of these pests produce two generations, some three (in the south). The most widely distributed among them is "sovka-gamma. It produces three generations. The first flight takes place in June, the second the end of July, the third in September. The female lays eggs in groups (several at a time); altogether 500 eggs. Caterpillars develop on the 6-7 day, live 20 days, injure leaves and sprouts of sugar beets. They pupate on plants in yellow white transparent cocoons. The pupating period lasts 10 days. Caterpillars overwinter in the upper layer of the soil and pupate right there in the spring. Sovka-gamma propagates heavily during hot summers, while beet growth is delayed at that time, a circumstance which increases the harm caused by caterpillars to the plant.

METHODS OF CONTROL are: destruction of weeds; deep fall plowing; dusting and spraying with poisons (4% barium chloride; 0.5% of sodium fluorite; 0.7% sodium fluoride or 0.2% of Paris green).

Tortoise beetles ("schitonoski"); two species are involved: Cassida nebulosa L., common tortoise beetle, and Cassida nobilis L. Chenopodium tortoise beetle ("marevaiia").

Both types are harmful and widely spread, although sugar beets are primarily injured by the common Cassida nebulosa L., a beetle 6-7 mm long, of rust brown color, dotted black; body and head covered by upper wings as if by a shield (hence the Russian name for it). The pest eats leaves and gives them a lacy appearance. It has two generations; one, May and June; the other, July and August.

Beetles appear in April and May and begin laying eggs in piles of 15 eggs, on leaves of sugar beets, pigweed and other Chenopodiacea. Every female lays ab. 200 eggs. In 5-7 days dark green larvae appear; their development lasts 15-25 days; larvae pass through 5 stages in the course of their life. Pupae last 5-12 days and the entire development 30-35 days. Adult beetles begin propagating 10-15 days after birth and in August the second generation makes its appearance and overwinters. In northern regions (Siberia) only one generation develops and beetles appear in the middle of June.

Methods of Control: Cultural treatment of fields, chemical means of destruction (same as above).

CLICK BEETLES (wireworms) ("Shchelkuny") (Elateridae) In principal sugar beet growing sections the following are most widely distributed: Broad click beetle (Selatosomus latus F.), Planting click beetle, (Agriotes sputator L.) ("posevnyi"); and brown-legged click bettle (Melanotus brunnipes Germ.), ("buronogii"); in Kiev and Vinnitsa obl. also the steppe click beetle (Agriotes gurgistanus Fald.), ("stepnoi"), and in Western Siberia, Siberian click beetle (Selatosomus spretus Mann.) ("Sibirskii"), in the Far East, Daur click beetle (Harminius dauricus Motsch.), ("daurskii").

Various crops, including sugar beets, are also injured by wireworms. These chew above ground sprouts, penetrate the more mature roots or devour thinner rootlets. Especially injurious are wireworms in the spring when they attack young sprouts. They appear on the surface of the soil in the spring; their mass flight is observed at a temperature of the air of 16-17°. Males do the flying, while females burrow into the soil and lay their eggs in small piles (3-5 eggs) at a depth of a few centimenters. Every female is capable of laying 130-150 eggs; their development takes 25-30 days; larvae develop in the soil during 4-5 years. Pupating takes place in June to August, at a depth of 8-15 cm. Beetles overwinter in the soil at a depth of 15-25 cm and are frost resistant; they are destroyed at temperatures of below 13-14°. Wireworms are found in fields in large quantities on ~~thickened~~ tight soils and in fewer numbers on friable soils.

Methods of Control: Agro-technical methods preserve the soil in a friable state and keep moisture; good cultivation of fallows, disking of stubble and deep fall plowing, frequent cultivation between rows, weed destruction and removal; also manual gathering of larvae in rolling and cultivating sugar beets.

Attractants of fresh green clover are thrown upon the fields; occasionally these are poisoned, though they do not prove very effective against wire-worms. Application of dust hexachloren may prove of help.

SUGAR BEET APHID (<u>Aphis fabae</u> Scop.) ("sveklovichnaia tliia); small (ab. 2 mm) insect of green-black color; found in all sugar beet growing regions especially in Western, moister zones. Its hosts are the Spindle tree (<u>Euonymus</u>) ("bereskleт"), <u>Viburnum</u> ("kalina"), Jasmin. It lays eggs on these plants in the fall and aphids develop in the spring. Leaves, when injured in June and July, curl and turn downwards, lose their elasticity, wilt and frequently dry out. Seedlings are equally affected by aphids; they wilt and frequently there is no yield of seeds at all. Every female lays daily 5-10 larvae and produces 120-150 eggs in its life cycle. Larvae complete their development in 10-15 days and begin propagating. By the end of August a part of winged aphids returns to plants that had originally fed them (spindle tree, jasmin, viburnum). Here they produce another generation which couples and lays eggs that overwinter.

Methods of control: a complex of measures to ensure vigorous growth of sugar beets. When aphids make their first appearance and leaves are not yet curled, spraying is applied with contact poisons: anabasine-sulfate (0.1% solution and 4g. of soap to 1 liter of water), total expenditure of mixture 700-800 l per hectare. Nicotine-sulfate (0.07% solution added to 4g. of soap and 1 liter of fluid), same amount of water; tobacco essence

(500-600g. of makhorka dust to 10 liters of water); 2% solution of laundry soap. Also dusting with 5% anabadust.

SUGAR BEET LEAF BUT ("klopik" Poecyloscytus cognatus Fieb.) small (3.5-5 mm) yellow-brown insect covered with silvery hairs that are easily wiped off. Capable of severe injury, sucks sap of plants in most delicate parts, upper stem and flowers, which dry out. Injury most severe in steppe regions where they attack sugar beets of first and second years. Found steadily in Siberia (Altai krai) and Krasnodar krai where they injure primarily transplanted seedlings. Develops in two generations in ab. 25 days (each). Second generation injures sugar beets primarily. The bugs transfer to sugar beets by the end of May and early June. Upon reaching maturity bugs begin propagating; eggs are laid in rows (3-8) in veins and petioles of leaves, and on upper part of runners in sprouts. One female lays 50-300 eggs.

Methods of Control: Destruction of wintering eggs of bugs by deep fall plowing (before weeds dry out), plowing of waste lands turning layer over before pests reach the winged stage; cutting weeds on roads and boundaries; burning all residue from threshings of leguminous crops; early planting of sugar beets on well-fertilized and cultivated soil; keeping fields free from weeds. Dusting of beets when pests appear with 5-6% anabadust or spraying with anabasine or nicotine-sulfate (0.5 l. of dust and 1.2 l. of liquid soap to 100 liters of water), total solution 650-700 l/h. Trapping bugs in nets.

SUGAR BEET LEAF MINER (Pegomyia hyoscyami Panzer)("sveklovichnaiia mukha"). Found in all regions where beets are grown; resembles somewhat the housefly (608 mm. in length), ash-grey color, back has dark elongated stripe, body red on the sides. Most frequently found on Umbelliferae. Females lay eggs on underside of leaves of weeds and beets singly and in rows, a few eggs at a time. One female lays 40-100 eggs in a season. At a temperature of 28°, lasting 2-5 days, and at a lower temperature of 8° (14 days later) wormlike larvae appear from eggs. They pierce pulp of leaves, make tunnels under the epidermis which are narrow at first and gradually coalesce into spots which extend over the entire leaf.

The larvae stage lasts 7 and 22 days, depending upon the temperature. Larvae next penetrate the soil to a depth of 2-10 cm (depending upon its humidity). Here they pupate; the adult pest flies out 13-32 days later, depending upon the temperature. The entire stage of development lasts 34-46 days. Cold and raw weather occasionally destroy larvae. The fly lives about two months.

Methods of Control: High level cultural treatment to increase beet growth; weed control, particularly of henbane, goosefoot, thorn apple, upon which the fly lays its eggs; destruction of eggs in thinning beets, as well of injured leaves.

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DISEASES OF SUGAR BEETS AND METHODS FOR CONTROLLING THEM

"Damping-off" ("Korneed") a disease of sprouts and seedlings up to 3-4 leaves stage of beets, it injures the rootlet and cotyledon elbow. Injured seedlings usually blacken and die. Brown spots or stripes appear on injured part of sprouts. These gradually spread and the entire underground part of the seedling blackens (black leg) at either the upper part of the rootlet or the underground cotyledon elbow where the blackened tissue coalesces. Occasionally the injured part of the plant continued to develop and gets much thicker than that of a healthy plant. The disease usually appears under conditions which do not provide for air accessibility into the soil, i.e. on heavy clayey soil, on low soils where ground water level is high and generally on soils easily inundated and forming crusts.

Thinning of beets under those conditions is dangerous if infestation is severe (20-30%); when infestation is low, beet plantings may be preserved with good care, although yield is affected.

Many micro-organisms attack weakened young seedlings; chiefly the fungi are: Phoma betae Frank, Pythium Debaryanum Hesse, Moniliopsis Aderholdi Ruhl.; various species of Fusarium, and bacteria - Erwinia amylovora (Burril) Winslow; Pseudomonas chloroaphis (Luignard et Sauvageou) Bergey; Serratia corallina Bergey; Serratia betae (Stutz), etc.

These micro-organisms are, nevertheless, unable to produce the disease unless plants are weakened and it is therefore most important to create better conditions for beet growth to avoid damping off.

Methods of Control: Progressive agricultural technique to provide better conditions for the development of sprouts and seedlings. Introduction of manure under deeply plowed soil, especially on heavy soils.

Of considerable importance in the control of root-eater disease is the role played in crop rotation by the grass layer which establishes soil structure and better aeration, both of which depress the development of the disease. Cultivation between rows and immediate destruction of the soil crust as soon as formed. Equally recommended is subsequent repeated cultivating without pulverizing the soil.

LEAF SPOT or CERCOSPORA is caused by the fungus Cercospora beticola Sacc. The disease appears in the form of spots on beet foliage, they are of round shape, edged in red-brown. A grey film appears later on the surface of spots, representing an accumulation of threads of the fungus and the large quantity of spores (conidia). When beets are severely infested the field takes on a black brown appearance, the foliage dies almost entirely, reducing growth, yield and sugar content considerably.

The disease strikes with particular severity during moist and warm summers and infests beets primarily in humid regions, Krasnodar krai and the Far East. Cercospora also attacks transplanted sprouts of sugar beets.

The inducer of the disease dies in the animal organism if infested foliage is fed to domestic animals; manure therefore does not transmit the disease. The fungus is also destroyed in ensilage and consequently leaves infested with cercospora may be ensiled. Foliage if left on fields may preserve the fungus for another year, however. (It dies only on leaves plowed under some 20-22 cm.)

Methods of control: Immediate gathering and ensilage after harvesting and cleaning of crop; compulsory deep fall plowing; destruction (burning) of residue of seed stock of beets.

Beet resistance to cercospora is increased by additional feeding.

Among chemical methods of control, spraying of plants with 1% Bordeaux mixture. Spraying must be done as soon as the disease is discovered and repeated no less than 3 times every 10 - 12 days. Spraying produces better results after rain and dew or on cloudy days, immediately after the leaves are dry; spraying has little effect in hot, dry weather.

Dusting of plants with copper-lime powder (1 part of dehydrated copper sulfate and 4 parts of dry lime are also used).

BACTERIAL LEAF SPOT is caused by a group of bacteria (Bacillus butyricus betae Koczura, Bacillus mesentericus vulgatus Flügge and Bacillus mycoides Flügge). On large areas and individual field plots beets are usually infested at the early stage (2-3 pairs of genuine leaves). On adult plants and sprouts of beets the disease occurs less often and injures them in smaller degree. It appears on foliage in the form of round, oily spots edged dark brown; the injured tissue gradually dies; punctures appear on the leaf (perforated spots). Complete destruction of leaves or disruption of assimilation may follow. Infested soil carries bacteria to leaves (raindrops).

Methods of control: Early additional feeding, especially with nitrogenous food.

MILDEW, the inducer is the fungus Erysiphe communis Grev.; injures beets in first and second years. The symptom - appearance on both sides of leaves of powdery film which represents the mycelium of the fungus and spores. At first lower leaves then upper are affected. The fungus spreads with the aid of spores throughout the summer and produces winter spores in the fall which overwinter. The disease appears in the second half of the summer (on some plants), gradually extending by the harvesting period. Stems, flowers and seed bolls ("klubochki") are affected on transplanted stock. Infested leaves wilt, yellow and lower leaves die first. Diseased plants are retarded in growth and their roots are of smaller weight than those of normal plants. Diseased seedlings produce small bolls of seeds of low germination. Foci of infection may be vegetative residues of transplanted material, infested seeds, transplanted diseased roots.

Methods of control: Treatment of infested seeds with formalin (1:300) for 5 min., subsequent saturation for 20 hrs.; dusting of plantings with sulfur (30-40 kg/h) or spraying with lime-sulfate solution (0.5^0 according to Boehme), whenever films appear; ensilage of foliage from diseased plantings and immediate removal of residue after harvesting from the field; their use (unsuited for forage) in ensilage or compost, or burning of residue. Deep fall plowing which causes fungi to die.

PSEUDO-MILDEW or Pereonospora; its inducer is the fungus Peronospora Schachtii Fuckel which injures sugar beets in first and second years. In the first year beet foliage is infested (especially young leaves) but transplanted material may also be attacked in some measure. Symptom of disease is the appearance of grey film with violet tint on the lower surface of leaves. A similar type of infection is noted on sprouts. Diseased leaves become delicate, bend or curl (curly disease). The inducer of the disease overwinters in infested post-harvested residues (stems, leaves), in roots of mother beets, seeds, and forms spores in the spring which infest beets. Spores are easily transferred from one plant to another and also to other fields. The fungus produces winter spores on infested plants which are preserved until the following year.

The disease develops primarily in cool, moist periods during the spring, attacking sprouts, and also by the end of the vegetation period when nights get cold. Sprouts are attacked after transplanting or through primary infestation (in the first year); they continue their development while the fungus overwinters on roots planted for seed. In the latter case the disease makes its appearance in early spring on the rosette leaves of sprouts and next on flower-bearing runners; results are unfertile and poor productivity plants.

Method of control: Spraying of foci of infestation with Bordeaux mixture 1% and subsequent destruction of individual diseased plants; treatment of seeds (from infested clumps) before planting with formalin (1:300) for 1-2 min. and subsequent saturation; observation throughout the summer of plantings of mother beets and of entire field before harvesting; all diseased plants are removed and destroyed.

Foci of infestation are sprayed with Bordeaux mixture; residue burned in threshing transplanted stock; immediately after harvesting deep fall plowing with foreplows on diseased fields to destroy spores of fungi.

RUST - inducer is the fungus Uromyces betae Pers.; injures leaves and petioles of beets in the first year, as well as runners and seed bolls on sprouts.

The disease appears in the form of small pustules, i.e. summer spores freed from the torn epidermis. Towards fall pustules acquire dark brown coloring and contain winter pustules. The aecidial stage (spring) of the fungus is seldom found, chiefly on transplanted material or sugar beet sprouts.

Winter spores which remain on vegetative residue on seeds and roots of mother beets until spring infest new plants.

Rust causes drying of leaves, reduces yields and sugar content of roots of beets, as well as yields of seeds.

Rust of beets was formerly considered a quarantine object; infestation of beet plantings was observed in the Ukraine during the post-war period. Methods of control are the same as against Peronospora.

MOSAIC is a virus disease which affects beets in the first year and injures transplanted stock primarily (p. 294). Mosaic injures garden and forage beets, Vicia faba L. var. equina Pers., and among weeds - "shiritsa", and Sonchus ("osot"), etc.

Some sucking insects transmit the virus of mosaic with the sap of plants. Control measures: weed destruction; planting away from beet fields (especially mother beet) and other plants susceptible to mosaic, as well as destruction of insect-hosts; immediate removal of roots after harvesting from fields and destruction of vegetative residue. Rejection of roots of mother beets infested with mosaic. Tests have established the considerable resistance of beets against mosaic provided plants are well nourished. (Mironov Station)

RED ROT or Rhizoctonia; inducer if the fungus Rhizoctonia violacea Tul. which injures roots of beets (p. 295). It is spread by plantings of infested root-seed stock or the introduction of manure into the soil obtained from cattle fed with diseased roots, as well as through particles of soil (agricultural implements) and other means. The disease infests, in addition to sugar beets, alfalfa, clover, vetch, potatoes, carrots, rape, etc. Control measures are: separate harvesting of beets infested with Rhizoctonia; the diseased part of root is cut off and destroyed, the healthy part is sent to the plant for immediate processing. Careful rejection of roots on plantings of mother beets; if the field is infested with the disease, the entire crop of mother beets is used for industry; if, however, infestation is in spots, the roots in foci are rejected. Mother beets infested with Rhizoctonia (only 1%) are kept in separate storing piles under close supervision; if towards the end of storing the percentage is 5%, the beets are pronounced unsuitable for planting and rejected; if the degree is below 5%, mother beets are treated with sulfur-lime solution (1:20) or formalin (1:300). It is to be noted that treatment of root-seed material with formalin sometimes reduces the yield of seeds. It is also possible to destroy the inducer of Rhizoctonia in the soil with a strong poisonous substance (chlorpicrin - 600 kg/h or carbon-bisulfide 2000kg/h).

TAIL ROT injures the tail end of the beet roots; the appearance is lead-grey or black (p. 296). Infested roots may get into stored piles of industrial or mother beets and serve as a focus of infection there. It develops mostly on low plots, irrigated land, where the water stagnates and access of air to roots is hindered, or on very tight soils. Many bacteria attack such injured roots which leads to the clogging of the vascular system and reduced access of water and nutrients to the root.

Control measures are: Good treatment of soil and in urgent cases draining; deep cultivation during period of care of plantings; introduction of high dosages of phosphorite fertilizers; regular watering of beets in irrigated regions in small amounts; careful rejection of roots of mother and industrial beets and their immediate processing.

BROWN ROT OF ROOT injures roots of sugar beets, chiefly on non-structural heavy soils of uninundated soils, valleys where water stagnates, and plots where ground water is of high level.

Micro-organisms, specifically the soil fungus Moniliopsis Adernoldi Ruhl, one of the indirect inducers of damping off on beet sprouts, attack roots of beets infested with brown rot. Control measures are the same as those used for tail rot.

FUSARIUM (p. 297). Control measures: all agro-technical measures contributing to the accumulation of moisture in upper layers of the soil; additional cultivating (when disease makes its appearance) and destruction of soil pests. Rejection of mother and industrial beets; destruction of diseased roots.

HEART ROT develops in the first year of beet planting; also in transplanted stock. Characterized by dying of point of growth. Young runners remain undeveloped, blacken and dry out (p. 298). Semi-saprophyte fungi, Phoma betae Fr., etc., injure diseased roots. Principal cause of disease is boron deficiency.

Control measures: Introduction of boron into the soil (6-10 kg/h of borax), and if disease appears during period of vegetation - additional feeding with boron; rejection of diseased roots, especially mother beet roots.

SCAB is a disease of surface tissue of roots, affecting beets in the first year. (p. 298) Inducer Bacterium scabiegenum F. causes pustular scab and infests beets chiefly on solonets soils. Common scab (belt) is caused by soil actinomyces: Actinomyces scabies Thaxter, A. cretaceous Krüger, A. nigrificans Krüger, A. albus Gasp., etc. The harm done by this disease (of whatever form) consists in the change of consistency of root which hardens. It has been also established that roots infested contain a high amount of harmful nitrogen. The disease is spread through infested root-seed material, other root crops susceptible to the disease, and also potato tubers. Damping off of beets also contribute to the development of the disease, as do excessive moisture of the soil and alkaline reaction of soil. Control measures: good initial soil treatment and cultivating between rows (to aid aeration); introduction into the soil of potassium cyanamide (prophylactic); rejection of infested roots in harvesting.

BACTERIUM OF ROOT. Inducers of disease are Bacterium Serbinowi Serb., Bacillus mycoides Flügge, Bacillus subtilis Cohn, Bacterium betae viscosum Buromsky et Matusch (p. 299). Disease is most frequent in stored piles of beets, both industrial and mother beets. Control measures are: prevention of roots from wilting and freezing in stored piles; rejection of diseased mother beet roots or their speedy processing.

ROOT CANCER - Bacterial disease, of which the inducer is Bacterium tumefaciens E. Sm. et Town. (p. 300). While the disease is widely spread, it attacks individual plants. Control measures: rejection of roots of mother beets before storing.

End of chapter.

Leshepekov, S. A.
New Potato Varieties of Ulianovskaia Experiment Station
Sad i Ogorod: 1950(7): 73-74. July 1950. 80 Sa13

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Translated from the Russian by
S. N. Monson

The Ulianov Potato Experiment Station began its work of producing new potato varieties adapted to the ecological conditions of the South-East beginning 1931. The results of varietal experimentation and study showed that potato varieties of foreign selection usually produced poor specimens with respect to productivity which degenerated rapidly proving unsuited to our conditions. The necessity for organizing potato selection and seed growing work under conditions of the South-East became therefore imperative.

The principal method from the start in producing new potato varieties was the selection of potato varieties, their study, testing and assignment into production. Subsequent selection work was based on artificial crossing. As a result eleven outstanding prospective seedlings were transferred in 1941 to the Government Network of Varietal Experimentation. Some of these are already regionalized at present and propagated under conditions of production at collective and state farms. The variety ULIANOV is regionalized for the Ulianov, Kuibishev, Chkalov, Saratov, and Rostov oblasts, the Krasnodar territory, the Bashkir and Mordov ASSR. The variety VOLZHANIK is regionalized for the Ulianov, Kuibishev and Sverdlovsk oblasts; the variety VESHPAEVSK for the Ulianov and Vladimir oblasts and for the Bashkir ASSR. 112

In potato selection we paid particular attention to the training of young sprouts under high agricultural standards, taking into consideration the fact that nutrition represents an important factor in creating good hybrid seedlings throughout the period of their growth, as well as in all tuber reproductions.

Leshepekov, S. A.

We are giving below a description of the best varieties:

Variety ULIANOV - clump tall, partly spread; stem lightly pigmented; flower white; tuber white, oval, skin smooth, surface eyes. Early maturing, of high yield, moderate starch content. Resistant to drought; satisfactory table and good keeping quality; produces high yields in summer plantings.

Variety VYEYTAEV - clump tall, partly spread; stem green; flower red-violet; tuber white, elongated, of pointed tip, smooth skin, surface eyes; medium maturing, of high yield; high percentage of starch content; superior drought resistance; good keeping quality; excellent taste; produces high yields in summer plantings.

Variety VOLZHANIN - clump tall, erect; flower white; tuber white, large, rounded; medium maturing, of high yield, large tuber; average percentage of starch content; resistant to drought; tasting and keeping qualities good; high yield in summer plantings.

End of article

2-27-51

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Kameraz, A. Ia. Agrotekhnika kartofelia v nechernozemnoi polose [Agricultural practices for potatoes in the non-black soil area]. Moskva, Gos. Izd-vo Selkhoz Lit-ry, 1949. 118 p. 75 K12

Translated from the Russian
by S. N. Monson

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Special methods of storing; storing in permanent quarters; preparation of storage quarters and the loading of potatoes; care of potatoes while stored; storage in temporary quarters; storage during the spring and summer periods.

End

Date: 2/1/51

Kameraz , A. Ia.
Agricultural Practices
Moscow, 1949

Translated in part by
S. N. Monson

VARIETIES OF POTATOES FOR THE NON-BLACK EARTH BELT:

REQUIREMENTS FOR POTATO VARIETIES (p. 75-86)

In the total (entire) complex of measures which ensure high and stable potato yields, the proper selection of varieties carries exceptional significance, i.e., the varieties most suitable to corresponding soil and climatic conditions and the maintenance of high seed qualities in seed material.

Shock workers obtain as a rule high yields by working with the best regionalized varieties for their particular zone.

In order to meet the requirements of production good, early, medium and late maturing table varieties are essential. For industrial use varieties of high yield and starch content are required.

Early varieties are essential in every oblast, primarily in the suburban zones of industrial centers, to provide the population with new potatoes during the summer. Every household should therefore maintain a proper correlation between early and late varieties. Late varieties which take longer time in developing produce high yields under normal conditions, are distinguished by a higher starch content, are more resistant to phytophthora, and do better in storage. For fall and winter consumption the later varieties are therefore preferable.

Considering that the consumption of new potatoes begins approximately in the middle of July and lasts until the middle of October, i.e. about two months, new potatoes should have an area designated to them that will ensure a two-months supply of table varieties. Areas allocated to early potatoes should have heavier soils. Early varieties will, if planted in time for summer use, be harvested before the appearance of phytophthora in sections where this disease occurs. Stored tubers will under those circumstances also keep better until spring.

Table varieties should, in addition, possess high taste qualities and well shaped tubers with small eyes. This requirement does not have to be met by forage varieties which may have lower taste qualities, but should possess a high yield. In zones of the distilling and starch-molasses (?) industries, industrial varieties possessing high starch content should be primarily distributed. The principal requirement expected of all varieties is their resistance to diseases of canker, phytophthora and others. The production of canker-resistant varieties represents the best method for controlling the dangerous canker disease.

In utilizing the original (initial) material for selection gathered by the All-Union Institute of Plant Industry, Soviet selectors produce at present phytophthora-resistant potato varieties. It is imperative to produce varieties of high quality and yield which combine resistance to canker and phytophthora. Of particular significance is the production of early canker-resistant and phytophthora-resistant potato varieties.

Considering the possibility that the Colorado Beetle may be introduced into the USSR, selective work utilizing new data collected by the Institute of Plant Industry for the production of high-grade potato varieties should be widely practiced with the view of producing varieties resistant to the Colorado beetle.

VARIETAL REGIONALIZATION OF POTATOES

Experiments on potato varieties for the purpose of establishing their suitability for any regions of the USSR are conducted on special varietal plots by the Government Commission on Varietal Experimentation (tests.) (See former article). On the basis of years of experimentation, as against accepted standards, all poorer varieties are rejected and the better varieties that exceed the established standard varieties in some characteristics are included in the lists of varieties that are recommended for certain oblasts, territories and republics.

With regard to rapid maturing varieties are classified into: early and medium maturing, medium late and late-maturing varieties; for economic production into: table, forage and industrial varieties.

Regionalized varieties are divided into three groups: basic, potential and temporarily admissible varieties.

[13 lines eliminated, describing the nature of the above three groups; this information has been translated elsewhere].

The following varieties have been regionalized for the different oblasts, territories and autonomous republics of the Non-Black-Earth

Zone of the RSFSR: Aberdeen Favorite, Belorussky, Berlichingen, Vermont, Wohltmann, Hero, Gollandsky, Great Scot, Imandra, Kalev, Cobbler, Kolkhozny, Korenevsky, Courier, Kungla, Leningradsky (S. 74), Lorkh, Majestic, Narodny, Parnassia, Paul Wagner, Early Rose, Rose of Millet, Silesia, Smyslovsky, Sovietsky, Phytophtora-Resistant, Epicure, Epron, Jubel.

The following varieties were regionalized for the various oblasts of the BSSR (White Russia): Early Rose, Epicure, Lorkh, Wohltman, Jubel, Berlichingen, Kalev, Kungla, Courier, Cobbler, Silesia, Parnassia, Sweetez, Phytophthora-Resistant, Belorussky, Ostbote, Vekaragis.

For the Finnish-Karelian SSR the canker-resistant varieties: Cobbler, Courier, Berlichingen, Great Scot, Jubel.

For the Lithuanian SSR the canker-resistant varieties: Ostbote, Parnassia, Milda, Majestic, Pepo, etc.

For the Latvian SSR the varieties: Majestic, Deodara, Erdgold, Bint'e, Edenwald Blue, Ostbote, as well as the canker-resistant varieties of local selection: Kalev, Kungla, Virulan, Piklik, Linda, Kollane.

BRIEF CHARACTERISTICS OF POTATO VARIETIES

ABERDEEN FAVORITE: Medium maturing, table, yieldy, canker-resistant; tubers round, white, small-eyed, white pulp, good taste. Starch and keeping quality medium.

BELORUSSKY (seedling 5780): Produced by the Belorussian Selection Grain Station. Medium-early, table-forage, yieldy, non-canker-resistant. Tubers roundish, flat, red. Starch content and keeping quality average.

BERLICHINGEN: Medium maturing, table, high yield, canker-resistant, relatively resistant to scab. Tubers oval, small-eyed, skin peeling, red, white flesh, average taste, starch content and keeping quality; sprouts(?) early in storage.

VALE: Produced in Latvia; late, table-industrial, medium yield, non-canker-resistant; tubers oval, red; starch content above average; good keeping quality.

VERMONT: Early, table, average yield; non-canker-resistant; tubers long, have many small eyes, dark-rose, of good taste; starch content and keeping quality average.

WOHLTMANN: Late, industrial, yieldy, non-canker-resistant; in practice resistant to ring rot; tubers roundish, small-eyed, skin red, not easily peeling. High starch content; good keeping quality.

HERO: Late, table-industrial; average and good yield; non-canker-resistant. Tubers roundish, small-eyed, skin peeling, red, white flesh; high starch content; good keeping quality.

GOLLANDSKY (MODEL): Very late, table-industrial; average yield; non-canker-resistant; tubers roundish, small-eyed, white peeling skin, white flesh; average starch content; good keeping quality.

GREAT SCOT: Medium maturing, table; average yield, canker-resistant; tubers roundish and round-oval, eyes not deep, white; white flesh; low starch content; keeping quality average.

IGARSKY (Seedling 101): Produced by M. M. Khrennikova from an inter-species crossing performed at the All-Union Institute of Plant Industry. Early, table, yieldy; tubers of average size, round, white, small eyes, light-yellow flesh; starch content not high; keeping quality good.

IMANDRA: Variety produced under northern conditions by the Institute of Plant Industry by intra-species hybridization. Early, and under other conditions medium-maturing, table, of high yield, canker-resistant and apparently also resistant to the more aggressive canker races, according to preliminary investigation. Tubers round-oval, flat, pink, eyes not deep, yellowish flesh; splendid taste; average starch content; good keeping quality.

KALEV: Produced by the IYGEVSKY Selection Station in Esthonia. Medium maturing, table, yieldy, canker-resistant; highly susceptible to wrinkled mosaic and ring rot; tubers turnip-shaped, peeling, skin white, medium deep eyes; white flesh; starch content below average; keeping quality average.

COBBLER: Early, table, yieldy, canker-resistant, non-resistant to ring rot; highly susceptible to phytophthora; tubers round, white, of white flesh; average taste; average and below average starch content; poor keeping quality.

KOLKHOZNY (Seedling 1969): Produced at the Novozybkov Experiment Station and the Institute of Potato Industry. Medium maturing, table, yieldy, non-canker-resistant; tubers long-oval; numerous, not deep eyes, white; white flesh; average starch content; good keeping quality.

KORENEVSKY: Produced at the Korenev Selection Station from the crossing of Sweetez X Smyslovsky. Medium late, industrial, yieldy, non-canker-resistant. Tubers round-oval; medium deep eyes; peeling skin, white; white flesh; turning brown on cutting; satisfactory taste, high starch content, good keeping quality.

KUNGLA: Produced in Esthonia from the crossing of Pepo X Centifolia. Medium maturing, forage, yieldy, canker-resistant. Tubers roundish, small eyes, white; white flesh. Average and below average starch content; average keeping quality.

COURIER: (Hammer and Sickle, Snezhinka 2, Snezinka 3). Early or under some conditions medium early, table, medium yield, canker-resistant, highly susceptible to phytophthora. Tubers roundish, flat, small-eyed, white; white flesh, tasty. Starch content above average; keeping quality of tubers not infected by phytophthora good.

LENINGRADSKY (Seedling 74): Produced at the Leningrad Zonal Potato Station from the crossing of Epicure X Centifolia. Medium early, table, yieldy, non-canker-resistant. Tubers oval, small-eyed, white, tasty. Starch content and keeping quality average.

LORKH: Produced at the Korenev Selection Station from the crossing of Swoetoz X Smyslovsky. Medium late, table-industrial, high yield, non-canker-resistant; tubers roundish-oval; occasionally long-oval; small eyes, white; white flesh; starch content above average; keeping quality good.

MAJESTIC: Medium maturing, table, yield medium and good, canker-resistant, tubers elongated-oval, of narrow base, smalleyes, white; white flesh; good taste; average starch content; good keeping quality.

MURMANSKY (156/72): Produced at the Institute of Plant Industry. Early, table, yieldy, canker-resistant; tubers round-oval, eyes not deep; white; starch content below average; keeping quality average.

MOSKVICH (18883): Produced at the Institute of Potato Industry; medium maturing, table, medium yield, non-canker-resistant, phytophthora-resistant. Tubers oval, eyes not deep, white; starch content average; keeping quality good.

NARODNY: Medium late; table-industrial, medium yield, non-canker-resistant; susceptible to diseases of degeneration; tubers round-oval; pointed at tip; eyes small or medium deep, white (get blue in the light in the spring); white flesh, which does not darken when sliced; tasty; starch content above average; poor keeping quality.

OKTIABRENOK (144): Produced at the Petrovsk Government Selection Station. Rapid maturing, table-industrial, yieldy, canker-resistant, according to available preliminary information; tubers roundish, eyes not deep, white; skin peels not easily; high starch content; good keeping quality.

OSTBOTE: Medium late; industrial; yield average and good; canker-resistant, tubers oval, eyes medium deep, yellow; yellow flesh, medium and high in taste; starch content high; keeping quality good.

PARNASSIA: Medium late, table-industrial, medium yield, canker-resistant; tubers oval, eyes medium deep, white; flesh white; starch content high; keeping quality good.

PAUL WAGNER: Medium late; table; average yield, canker-resistant; tubers oval, eyes medium depth, white; white flesh; starch content and keeping quality average.

PEREDOVIK (3598): Produced at the Institute of Plant Industry. Medium early, table; yieldy; canker-resistant judging from preliminary data; tubers elongated-oval, small eyes, red, smooth skin; white flesh; starch content average; keeping quality good.

PRIEKULSKY RANNY: Produced in Latvia from the crossing of Cobbler X Jubel. Early, (under some conditions medium-early), table, average yield, canker-resistant, tubers oval, eyes not deep, white; flesh white. Starch content and keeping quality below average.

EARLY ROSE: Early, table, medium yield, non-canker-resistant, severely susceptible to phytophthora and diseases of degeneration; tubers elongated-oval, slightly flat; skin rose; white flesh, very tasty; starch content average; poor keeping quality.

ROSE FROM MILIET: Local variety; medium maturing, table-forage; yieldy, non-canker-resistant; tubers elongated-oval; small eyes, rose; white flesh (occasionally violet spotted); average in taste; starch content low, keeping quality average.

SWEETEZ: Late, industrial, average yield, non-canker-resistant; tubers roundish, white, medium deep eyes; easily peeling skin, white; flesh white, reddens in slicing; starch content high; keeping quality good.

SILESIA: Late, table-industrial, medium yield, non-canker-resistant; tubers oval, frequently elongated at tip, eyes medium deep, skin peeling; flesh yellowish, pink when sliced, satisfactory taste; starch content high; keeping quality average.

SMYSLOVSKY: Medium maturing, table, average yield, non-canker-resistant; tubers long-oval, eyes medium deep; white; flesh white; tasty; starch content above average; keeping quality good.

SOVIETSKY: Produced at the Koronev Selection Station from the crossing of Narodny X Smyslovsky. Medium early, table-industrial; yieldy, non-canker-resistant; tubers elongated-oval, eyes not deep, white; flesh white; starch content above average at early accumulation of starch; keeping quality average.

PHYTOPHTHORA-RESISTANT (8670): Produced at the Institute of Potato Industry. Medium maturing, table-industrial, average yield, canker-resistant; resistant to phytophthora under field conditions.

Tubers long-oval; small eyes, net-like, peeling skin; blue-violet; flesh white, does not darken in slicing; starch content and keeping quality average.

KHRENNIKOVSKY (Seedling 96): Same origin as variety Igarsky; early with early and intensive tuber formation; table, yieldy, tubers large, oval, smalleyes, white; flesh white, good taste; starch content not big; keeping quality good.

EPICURE: Early, table, medium yield, non-canker-resistant; severely susceptible to wrinkled mosaic, ring rot, phytophthora; tubers barrel-shaped, deep-eyed, white, later flesh-colored; white pulp. Starch content below average; keeping quality good.

EPRON: Produced at the All-Union Institute of Plant Industry together with the Leningrad Zonal Potato Station. Early, table, yieldy, non-canker-resistant; tubers roundish, eyes medium deep, white; flesh white; starch content low; keeping quality good.

JUBEL: Medium maturing; table; average yield; canker-resistant; relatively resistant to scab; tubers elongated-oval, slightly flattened; eyes medium deep, white; flesh white; darkens in slicing; starch content average; keeping quality good.

IUBILEINY (1): Produced at the Petrovsky Government Selection Station. Rapidly maturing, yieldy, non-canker-resistant; tubers barrel-shaped, eyes not deep, white. Starch content average; keeping quality good.

End of Chapter

Kameraz, A. IA. Agrotekhnika kartofelia v nechernozemnoi polose [Agricultural practices for potatoes in the non-black soil area]. Moskva, Gos. Izd-vo Selkhoz Lit-ry, 1949. 118 p. 75K12

Translated in part
by S. N. Monson

POTATO PESTS

Wireworm (Elateridae) (p. 107-108)

The wireworm or the larva of the click beetle causes frequently much damage to potatoes. The wireworm gnaws at young shoots, especially at potato seedlings, gnaws its way into the tubers which spoils their commercial value and aids the transfer of several diseases.

Control is conducted by the application of a system of agricultural practices. Black fallow, deep plowing, timely destruction of weeds, etc. The most effective measure is grass field crop rotation. According to V. R. Williams, the harmful organisms which live in the soil, as well as their wintering forms, are aerobic. A prolonged stay under anaerobic conditions (without adequate air supply) leads to their extermination.

To create conditions in the grass state of crop rotation for the elimination of the viability of larva certain measures are essential: the sowing of grasses under winter crops (not summer crops), the harrowing of grasses after each cutting (spring harrowing is not permissible), the ensuring of a normal density of grasses throughout the period of their use, the raising of the layer (bed) of perennial grasses in the late fall by plowing with foreplows.

Among chemical control methods good results were obtained by the application of hexachloran.

Hexachloran preserves its toxidity in the soil throughout the vegetative period. It is introduced in the spring during plowing, or prior to sowing under the harrow, in the proportion of 15-20 kg. per hectare of pure (technical) preparation. For a more equal distribution it is recommended to apply it mixed with soil and fertilizers.

Hexachloran is introduced during crop rotation on fields planted with cereals, cereals with an admixture of clover, and on pure fallow. It should not be applied directly to potatoes and root crops because the latter then acquire an unpleasant odor and taste. In order to destroy the wireworm on a potato field, hexachloran may be introduced (applied?) to the preceding crop. Sowings of potatoes are sometimes damaged by the caterpillars of Noctuidae (stem borer), the larva of the May beetle, etc.

Methods of Control: Destruction of weeds, early plowing, the introduction into the soil of attractants, dusting or spraying of plants with poisons. Hexachloran proves effective in also controlling these pests.

End of chapter

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Medvedev, P. F.
Changing the Nature of Potato Varieties by Altering the Conditions of Their Cultivation.
Sad i Ogorod 1949(3):59-61. Mar. 1949. 80 Sa13

R-51

Translated from the Russian by
S. N. Monson

In solving the problem of potato growing in the southern steppe regions, the matter of obtaining double yields during one vegetative period by utilizing freshly-dug tubers carries much significance. This method relieves the farm of the necessity for maintaining large accumulations of seed material for long periods (9-10 months) and at the same time transfers potato growing to a period devoid of high temperatures which contribute to potato degeneration.

To obtain two yields of potatoes a year, varieties not requiring dormancy, i.e., biologically double-yielded varieties are required. These were obtained under northern conditions, at the Polar Station of the All-Union Institute of Plant Industry (VIR) by crossings of cultivated varieties with the wild species Solanum boyacense. However, these varieties do not equal in quality our standard varieties, such as Early Rose, Lorkh, etc.

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In this connection we set ourselves the task of modifying the biological characteristics of the standard and potential varieties for our zone, doing away with their period of dormancy and obtaining double yields from early maturing varieties for steppe regions.

In attacking this problem we followed Michurin teachings which guided the way to an acceleration of provisions of vegetative forms required by man.

The following varieties were selected for modification into double-yield varieties: Early Rose, Epron, Courier, Ella, Lorkh, Majestic, etc. From among the late maturing, the variety Wohltmann was chosen. The biologically double-yield variety Khibin -3 served as control.

Conditions for planting were: early spring planting (March); harvesting of the first yield by June 20-25, at the time of the physiological immaturity of tubers of the majority of varieties and even at the beginning of their tuber formation (Wohltmann). After harvesting the tubers were kept for further growth in nurseries, under high temperature and increased moisture. When grown the tubers were transplanted in the second half of July into plots.

Following such dates of planting the entire cycle of development, especially the tuber formation of potatoes, took place at low temperatures of late spring, early summer and fall. All varieties were subjected to directed selection on the basis of the rapid growth of freshly gathered tubers.

The capacity for tuber growth after harvesting varied among the different varieties. Tubers of the varieties KALITINETS, EPRON, WOHLTMANN, MAJESTIC, grew poorly. The varieties LORKH and ELLA responded best to the change in environmental conditions.

In two years of experimentation (1947-1948) an average of 99 per cent of freshly-gathered tubers of the variety ELLA were obtained; from LORKH, 95 per cent; the control KHIBIN 3, 97 per cent. Simultaneously tubers of the variety WOHLTMANN produced 54 per cent and the variety MAJESTIC 83 per cent. In the three years of experimentation (1946-1948) six generations of tubers of the varieties LORKH and EARLY ROSE were obtained; of the rest, 4-5 generations. Many varieties were included in the experiment only beginning 1947.

The greatest change in characteristics under the influence of altered conditions of production was observed in the medium-late variety LORKH. In which manner did the morphological nature of the plant change during the period of experimentation?

In the sixth generation the double-yield variety LORKH increased its leaf in length 44 per cent, as compared with the common summer grown variety LORKH. The number of lobes increased 88 per cent, the height of the plant was reduced 37 per cent, the runner formation was almost a third less. The shape of the tuber changed from flat-rounded to elongated-elliptical. Along with the changes in morphological traits noticeable modifications were obtained in the biological characteristics of the double-yield plant. The variety became early maturing.

In 1948 the plants of the changed spring-grown variety LORKH bloomed simultaneously with the plants of Early Rose, and the summer-grown plants earlier by two days. In the fall of 1948 an increase in the resistance of double-yield varieties to frost was observed. At the first brief early frosts in early October the usual plantings were destroyed or severely injured. In the same period plants of double-yield varieties continued to vegetate up to the first killing frost which occurred November 13.

With regard to tuber formation, double yield LORKH may be assigned to the group of early maturing varieties. This is supported by the greater yield during a relatively brief period of spring and fall vegetation. Its yield, from two harvests considerably exceeded that of other varieties which participated in the varietal tests, including that of the one-yield LORKH variety (see table).

YEARS	Yield of Tubers in c/h according to varieties: Double-yield Lorkh	Double-yield Early Rose	Lorkh at spring planting	Lorkh at fall planting
1946	70	62	82	53
1947	156	120	81	168
1948	267	147	147	152
Average	164	110	103	124

On an average in three years of testing 164 c/h of tubers of the double-yield Lorkh variety were obtained, or 49 per cent more than the yield from double-yield Early Rose and above the ordinary Lorkh variety by 59 per cent in spring planting and 32 per cent in summer planting.

Noticeable changes took place equally in other varieties submitted to directed training for 4-5 generations. Of particular interest was the change of the late maturing variety Wohltmann, of negligible yield, into an early maturing, double-yield variety, although work in this case has not been completed as yet. In 1947 95 c/h of Wohltmann tubers were obtained from two yields; in 1948 197 c/h, while the control Khibiny 3 produced 203 c/h.

Thus the modification of conditions of production altered the morphological, as well as the economic-biological characteristics of potato varieties.

The above data supports the practicability of Michurin's theories concerning the modification of cultivated plants and the significance of this work for a substantial increase in yields of agricultural crops and their introduction into new regions for production. Double-yield varieties will within the next few years be given wide distribution in steppe conditions of the unstable and moisture-deficient Northern Caucasus.

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End of article

2-28-51

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Katsentov, D. I. and Maksimov, A. A.
Opyt peredovikov-kartofelevodov
(Practices of the leading potato
growers). Moskva. 1949 105 p.
75 M213

Translated from the Russian by
S. M. Monson

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1/11/51

Leningrad. Institut Zashchity Rastenii.
Metodicheskie instruktsii k planu nauchno-issledovatel'skikh rabot Vsesoiuznogo Instituta Zashchity Rastenii 1935 g. (Systematic instructions on the plan of scientific research work of the All-Union Institute of Plant Protection). Leningrad, 1935. 464.4 L54M

Translated by S. N. Monson

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Leningrad. Institut Zashchity Rastenii.

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4/17/51

Volkov, V.F.
Principles of the organization and work of the Record Service of the Institute for Plant Protection in the year 1935. Zashch.Rast. 2:29-34. 1935 421 P842

Translated in full by
S. N. Monson

The Decree of NKZ (Narkomzem) ( ) of USSR of November 16, 1934, under No. 5856, concerning the planning and organization of pest and disease control of agricultural crops, radically reorganized the Record Service Division relating to pest and diseases of agricultural crops which, following the liquidation of OBV ( ), in the spring of 1934, was placed under the control of VIZRa ( ).

Operative signalization [warning] and mass surveys of pests and diseases of agricultural crops were assigned to branches engaged in the control of pests in krai and oblast land administrations and NKZ of republics conducting this work through RaiZO ( ) [Regional land organization], MTS ( ), and state and collective farms.

The following tasks were placed upon the Record Service of VIZRa.

a) To record the development of pests and diseases and compile seasonal and long-term prognoses.

b) To establish indicators of harmfulness and losses.

c) To establish a selective record of the economic and technical efficacy of the measures employed.

d) To study, develop and transfer to industrial organizations the system of surveying pests and diseases and record the technical efficacy of measures undertaken to control them.

e) To study the regionalization of pests and diseases.

f) To expose the natural-economic conditions affecting the distribution and development of pests and diseases.

This distribution of the function of the Record Service will on one hand permit the participation of collective and state farms in the task of recording, while on the other hand, it will extend the work of observation points with respect to recording pests and diseases, lead to the determination of ecological conditions affecting their development, the study of losses from pests, and the efficacy of the measures used which, in turn, will solve more rapidly the entire complex of tasks confronting plant protection work.

In comparing the above duties of the Record Service of VIZRa with those the organization had faced in the past, when under OBV,(   ) we observe the following changes:

1. The duty of regular signalization, used to announce the appearance of pests and diseases of operative [actual] and economic significance has been removed. It is transferred to local farm and land organizations which undoubtedly are executing it by using the experience of the Record Service.

2. A new division for the regionalization of pests and diseases has been introduced. This division occupies one of the most important places in the work of the Record Service and represents one of the leading subjects of VIZRa. The ecological-economic regionalization of the territory of the USSR with respect to pests and diseases is one of the essential premises for the scientifically documented distribution of measures in pest control, designed to establish regularity in their distribution and development and provide well-founded prognoses. Widely administered work on regionalization by VIZRa will undoubtedly unify all scientific research organizations and individual scientific workers engaged in this field, and if given proper aid and consultation by VIZRa may be accomplished faster by using necessary scientific methods.

It is evident that along with regionalization on a Union scale, regionalization arranged on a scale for oblast(s), krai(s) and republics should be similarly organized. VIZRa should in the near future develop systematic directions on problems of regionalization for the benefit of local scientific research institutions and establish an uninterrupted consultation service on the subject extended by the Bureau of Regionalization of VIZRa.

Conforming with the change in tasks assigned to the Record Service, the decree of the Presidium of the Lenin All-Union Academy of Agricultural Sciences simultaneously altered the structure of organizations of the Record Service.

In place of the Administration of the Record Service of VIZRa and its branches, situated in the past in all oblast(s), krai(s) and republics, a Sector of Record and Regionalization is organized at VIZRa while on the periphery nine groups of Record Service under VIZRa, are set up, of which five are located at the Moscow, Voronezh, Azovo-Black Sea, Azerbaidjan and Central Asiatic branches of VIZRa and four independent groups are established in the Ukraine(Kiev), Kuibishev, Novosibirsk and Alma-Ata.

The Sector of Record Service and Regionalization of VIZRa represents the organizational-planning and systematic center which unites the entire work of the Record Service conducted by the network of observation points and VIZRa.

The Sector of Record Service and Regionalization of VIZRa supervises the development of programs and plans of records, economics and regionalization, the distribution of the network of observation points throughout the territory of the Union, its financing, the development of the system of recording; it provides general supervision over the work of the Record Service, guides the

issuance

of timely seasonal prognoses, annual and perennial surveys that provide prognoses for the following year, observes that plans of the Record Service are fulfilled throughout the VIZRa System, arranges consultations on problems of recording, regionalization and economics, and organizes the collecting and systematizing of results in scientific research.

The Sector of Record and Regionalization consists of the respective sections of recording and prognoses, regionalization, economics, and that of storing scientific data.

A Bureau of Regionalization is set up to administer regionalization at the Sector of Recording and Regionalization. Its duty is to approve plans, systems and results in connection with regionalization.

The direct administration of observation points, the compilation of prognoses and surveys of pests and diseases, the use of material on recording losses and the efficacy of measures for control and regionalization are functions placed upon the newly organized branch sectors of VIZRa with reference to: grain and leguminous crops, northern spinning crops, southern spinning crops, sugar beet, vegetables and woody crops.

The participation of the entire system of VIZRa in the Record Service will undoubtedly contribute to a faster fulfilmment of the task assigned to VIZRa by the Presidium of the Academy concerning the development of complex measures, for the construction of which the entire data previously assembled by the Record Service should now be utilized, as should be the increase of the level of the entire work of the Record Service.

The task of groups of the Record Service includes: selection of scientific personnel at observation points, their financing, according to estimates and plans confirmed by VIZRa; control over the fulfillment of their work and the proper application of systems established at observation points by VIZRa, as well as instruction of observation point personnel. Thus groups of the Record Service are basically organizations of inspection of VIZRa, their working capacity designed to ensure the checking of errors that may occur at points during the process of work and to stimulate the fulfillment of plans assigned to the latter.

In some oblast(s), krai(s) and republics there is a tendency to delegate to groups of the Record Service functions of the former branches of the Record Service Administration. These tendencies contradict the decision of the NKZ. Groups of the Record Service should under no circumstances assume the functions of the former FUSU ( ), since they do not have at their disposal the wide-spread network of observation points and MTS( ) which were instrumental in collecting material, nor do they possess the working personnel formely employed by FUSU.

Local land organizations(organs) are expected to organize signalization themselves rather than attempt to utilize improperly groups of the Record Service; should ensure the collecting of data necessary for the current conduct of pest and disease control, the planning of measures for the protection of agricultural crops, by using the data provided by observation points and scientific research organizations. Land organizations are to devote particular attention to mass surveys through state and collective farms of the most important pests and diseases, since without the latter data proper distribution of measures in oblast(s), krai(s), republics, and regions is not possible.

The network of observation points of the Record Service of VIZRa is set up at the principal natural-economic regions of the USSR, and consideration is given to entomo-phytopathological regionalization.

Observation points of VIZRa are as a rule, of a complex nature, i.e. each point services all principal crops of its region, a staff of 3 - 5 people conducting work on entomological and phytopathological objects. Depending upon the number of recorded objects and crops there are either one or two specialists-entomologists, one or two specialists-phytopathologists, one specialist-zoologist (in regions of mass distribution of harmful rodents) and one laboratory helper.

Allocation of observation points of the network on the territory of the USSR ~~is done~~ by VIZRa and is confirmed by VASKHNIL (   ) of NKZ of the Union. In 1935 a decree of the NKZ confirmed 123 observation points in place of the 367 existing in 1934. The radius of activity of observation points is limited to 10 to 20 km, depending upon the nature of the territory and the peculiarities of crop location. Observation points conduct their entire record-surveying work on this territory. In addition, observation points on special assignments of VIZRa may conduct surveys on a larger territory, exceeding the limits of their activity at particular points.

All observation points follow plans confirmed by VIZRa. In connection with the reorganization of the Record Service, the subject and nature of the work of observation points is radically changed, compared to 1933-34. If previously an observation point represented fundamentally an appendix to local operative organizations and the latter frequently, disregarding the consequences, which reduced to zero the work of observation points in the course of a year, mobilized workers for pest control, conducted mass surveys, collected funds, etc., a considerable part of the personnel of observation points did not possess adequate qualifications for conducting intensive record-survey work. At present, because of a reduced number of observation points, the latter are for the most part staffed with qualified personnel.

Observation points are intended to be scientific research units equal in value, so as to ensure/the collecting of data essential for the ecological-economic regionalization of pests and diseases, the establishment of prognoses concerning their development, the presentation of estimates of losses from pests and diseases and/to indicate the efficacy of controlling them latter.

Into the task of observation points of the Record Service of VIZRa enter, according to the confirmed decree:

1) Study of the composition of species, distribution according to stages and dynamics (course of development, number, sexual reproduction, limiting factors) of pests and diseases fo agricultural crops.

2) Study of the economic significance of pests and diseases (injury, harmfulness, losses).

3) Selective evaluation of quality of measures of pest and disease as conducted by state and collective farms, with detailed exposition of the condition of their respective organization.

4) Participation in the development of a system of surveys and estimate of the efficacy of measures, as well as the administration of other scientific research at VIZRa.

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Observation points compile informative statements based on conducted work, concerning the anticipated development of pests and diseases oß operative significance, make short term prognoses on pests and diseases having multiple generation, and present annual surveys on the development of pests and diseases of agricultural crops in regions of the point's activity, provide prognoses on the most important pests and diseases anticipated in the following year.

The change in the content of the work of observation points demands the application of intensive methods of recording. Specifically, particular attention should be devoted to the pproper organization of stationary work which in previous years did not receive proper attention.

Observation points in conforming with the regulations concerning their work attend to:

1. Bio-phenological observations of the course of development of pests and diseases and the simultaneous determination of phases of development of forage plants.
2. Periodical estimates of the biological condition of principal pests and diseases (estimates of sexual reproduction, injury of pests by parasites, etc.)
3. Selective surveys on distribution and number of pests and diseases, adapted to definite phases of the development of pests and cultivated plants.
4. Selective recording of harvests on undamaged and damaged, as well as cultivated and non-cultivated plots of sowings.

Record-observations performed at work points should invariably be accompanied by an analysis of ecological conditions under which the development of estimated recorded objects takes place, which demonstrate the damage to agricultural crops, as well as by a collection of factual data confirming the results of the work (collection of pests, specimens of forage plants, injuries, diseases, etc.)

On the basis of the data obtained by observation points in the process of their work, the points maintain lists of pests and diseases of their particular region, gather factual data on fauna and microflora, compile indicative and reference collections of pests and diseases of agricultural crops, compose maps on stage distribution, charts on the development of individual objects, depending upon their temperature and moisture and other data, which characterize the degree of study made of pests and diseases in a serviced area.

The results of the work of observation points are summarized in special informative statements and prognoses which are forwarded to MTS AN RaiZO (   ) of their region, OblZU (   ),KraiZU (   ), Narkomzem (   ) and VIZRa.

Annual surveys covering all pests and diseases registered in the region of activity of an observation point, providing a prognosis on the development of pests and diseases in the sudceeding vegetative period, are forwarded to OblZU(   ), (or KraiZU(   ) or Narkomzem(   ) and VIZRa no later than by December 31.

In addition, observation points forward to VIZRa every ten years copies of allfirst records on the 10, 20, and 30 of each month, which should include results of recordings and observations and, upon special demand, must produce herbariad and collected data with specimens of pests and deseases in confirmation of the written statements submitted by the points.

The practice of preceding years indicates that observation points frequently burden themselves with work on secondary objects in spite of plans assigned to them, with the result that some observation points (Uzbekistan and others) limit themselves to an ordinary registration of facts rather than to a careful recording of the study of causes contributing or interfering with the development of major

operative objects. Similar practices should not prevail. Tendencies observed in
in Central Asia at observation points/to load themselves with scientific work on subjects of secondary importance at the expense of the quality of work on assigned objects should be discarded.

There is no doubt that the results of the work of observation points are of significant interest to scientific research organizations on plant protection located in areas of activity of points, their relationship should be solved in each particular case dependent upon concrete situations (on exchange of data, mutual consultation on various objects, etc.).

In conclusion it is necessary to dwell upon one of the most important tasks assigned to observation points which concern the introduction of methods of simplest recording among the wide masses of collective farmers,/to contribute to the/latter's understanding of the significance of the work of plant protection and of the utilization of results obtained from their observations in the course of the organization and application of measures of control.

Here collective farm cottage-laboratories are able to play a decisive role. Observation points should, as a rule, maintain live contact with all cottage-laboratories that enter into the sphere of their activity, aid the organization of divisions of plant protection within them, familiarize the staff of cottage-laboratories with the specific pests and diseases causing damage to plantings on their collective farms, refer to their economic significance, and aid in the proper organization of measures in controlling pests and diseases (verification of dosages, proper application of poisons to various plants, timely measures, etc.)

The practical participation of observation points in the work of cottage-laboratories will undoubtedly assist the latter in drafting active correspondent-members among collective farmers, capable of throwing systematically light upon the situation, as pertaining to pests and diseases on their fields, a circumstance that will aid considerably in the correct and fast solution of the entire complex of tasks intended to raise the yield of socialist fields assigned to observation points of the Record Service.

End of article.

4/25/51

Naumov, N. A.
A brief survey of the attainments of Soviet phytopathology. Zashch. Rast. 19:108-119. 1939. 421 P942

Translated from the Russian by
Rosa G. Dembo

The condition of phytopathology, as we observe it at the present time differs from its condition in pre-revolutionary times in the same degree as the agriculture of the Soviet Union differs from the same in Tsarist Russia.

The Great October Socialist Revolution, which brought about the change in the entire social structure, which ensured the shifting to socialistic forms and methods of labor, aroused tremendous improvement in all fields of human activity.

The socialistic reconstruction of agriculture not only changed the age-old attitude concerning diseases of crop plants, but also suggested to the young soviet science new requirements. It was quite natural in prerevolutionary times to have an insufficiently serious approach to the diseases of plants, and often even an underestimation of its significance, which was explained by the ignorance of the wide masses of the population of the essence of the phenomena. Besides, the stimulus undoubtedly was lacking for the constant application of prophylactic and healing measures of control because the initiator of some measure never was able to be certain that his start would be picked up widely enough; meanwhile, the guaranty of success in control of plant diseases, as it has been clear without special evidence, lies in the popularity of its application . Finally, the very economy of separate small farms did not promote a wide application of means and methods for control. 118

Along with the conditions of applying protecting and healing methods, in connection with the reorganization of agriculture on new premises the conditions of investigation of the diseases themselves have changed as well. The Soviet phytopathology differs from prerevolutionary first of all by its development according to plan, by subordination of private interests of science to common interests of national economy. It is quite natural that at the beginning research underwent some curtailment; this, undoubtedly, indicates the fact that the thoroughness of working out of topics which are considered more important increased at the expense of pushing aside some subjects of lesser importance.

A very characteristic feature of contemporary phytopathology is its expediency which includes a full negation of uncertain, indefinite formulations of subjects and which places the number of necessary conditions of scientific work the obtaining of practically valuable results. The approach of the research to the interests of agricultural production required a considerable change in plans of scientific research institutions and a considerable reorganization of conscientiousness of specialists who had to understand that science for the sake of science, as a matter which does not have any roots in practical life, can not exist and can not make use of the support and confidence of the masses.

Along with that the basic reorganization of agriculture in the Soviet Union brought forth for phytopathology a series of new problems connected with the movement of life which have to be worked out first. A part of these new problems is connected with the intensive widening of the domain of agricultural crops. If in prerevolutionary time the number of cultivated plants was sufficiently limited, whereby they became frozen within certain limits, since the introduction of new cultures was coincidental and rare, often carried on in amateurish fashion, now we observe a tremendous widening of the assortment of cultivated plants, which is on account of intensive work in cultivating new native useful plants (for instance, rubber plant and others) and in the way of introducing some valuable foreign plants which are well recommended.

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The introduction of new varieties into the country and the improvement of the old ones, according to the methods of I. V. Michurin and the academician, T. D. Lysenko, increased also the number of subjects which are under the jurisdiction of phytopathology. All this serves as cause for many existing changes in phytopathological topics. It is necessary to add also the possibility of including them among the new diseases which did not occur before; the danger of such introduction of parasites along with the introduction of plants is very great. It is necessary to mention here that the degree of such danger, as a result of creating in the Soviet era the service of quarantine, is to a considerable degree paralized.

Another part of these new inquiries is connected with problems of disposition of plants in Union territory. The shifting of many oblasts from the group of consumers into the category of producers, the widening of areas for wheat, cotton, sugar beets and other plants, accompanied by the shifting into regions new for them, finally, utilization of the land of the far North and East - also promote in plant protection, especially in phytopathology, new and very vital problems.

Finally, the last directives of the party and of the government on the increase of crops in grains, cotton, sugar beets and the direct indication of comrade Stalin to the XVIII Congress of VKP(b) (ВКП(б)) (All-Union Communist Party) concerning the increase of yearly crops to 8 billion poods - all this forces the phytopathologist to approach the solution of the task ahead of him from a different point of view.

At the same time the very character of the activity of the phytopathologist connected him more closely with production itself - plant growing, requiring a business-like and daily contact with agronomist, vegetable grower, gardener, etc. and making more vital the relationships which were slightly existing before - be-

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between the selectors, geneticists, physiologists, etc.

It is quite clear that the economic foundations for plant protection should be entirely reevaluated. Essentially the approach towards the adaptation of various measures, which is determined by self-repayment remains the same. Nevertheless, the slight benefit of the measures should not be a reason for the refusal of their application. In such a condition is, as it is known, the aviomethod in application of rust of grains, etc.

As very significant for the present condition of phytopathology could serve the character of directions in research work. The tendency for rationalization of active measures in control of diseases (dusting, spraying, etc.) entailed intense attention to such domains of work, which were formerly neglected or were completely unknown. Thus, the tendency for the simplification of the schedule for spraying in protecting many plants provoked the study on forecast - a quite new circumstance which can rest upon the detailed study of behavior of the parasites in question depending on external conditions. This purely biological problem took shape only at a recent time, its contents is based on detailed information in the field of biology of parasites in their relationship to the environment.

One may say without any exaggeration that in this domain in the USSR there has been achieved greater progress than in any capitalistic country; this depends on the amount of work (the diseases of fruit bearing trees, of potatoes, cotton, dusty smut of wheat, rust, some diseases of vegetable plants), but still more on the degree of the deepening in this new field of phytopathology, which led to fixing mathematically determined measures (nomograms of N. A. Naumova concerning Phytophtora on potatoes and two kinds of rust on grains).

At the same time essential progress is noticeable in the question of study of distribution of parasitic organisms in nature. The investigations of K. M.

Stepanov indicated that there exists a connection between the pecularities of cryptogamous organs of parasitic fungi, the physical properties of their spores, the amount of the same - on one side, and the physical behavior of the air, its motion, weather condition and corresponding conditions - on the other. All this leads to the possibility of evaluation of the source of infection in connection with its intensity (one or several affected plants or the huge surface under them) and the remoteness of the protected plants.

A special tendency which theoretically has been worked out only in our country, is the harmfulness of the diseases. Taking into consideration that any disease is harmful, it is necessary in phytopathological work to be able to make a comparison of various diseases between themselves (for instance, brown and yellow rust of wheat) and also to determine the degree of the injury caused by the disease on various crops under various conditions in cultivating plants (the significance of terms of sowing, fertilization etc.); and finally, it is equally necessary to be able to evaluate the decrease of the injury caused by the disease in connection with the applied control measures (dusting, spraying).

The methodology of such work, as worked out by A. A. Shitikova-Russakova, permits the indication by way of mathematics with great precision of the harmfulness of grain rust. The biological side of harmfulness of parasites and, particularly, the mechanism of their influence upon the plants were studied and are studied in application to various groups of parasites by many investigators from anatomical and physiological points of view (academicians A.A. Rikhter, K.T. Sukhorukov, V.N. Shevchenko, V.F. Kuprevich, A. Ia. Kokin, Kh. Tumarinson, O. N. Malchenko). It is important to note that the problems of physiology of the diseased plant are studied simultaneously from two sides, by the active participation of

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phytopathologists and of physiologists.

The rating of the spreading of plant diseases - most important domain of phytopathology - could be considered as one which originated in our country without any influence on the part of foreign research, since in the capitalistic countries nothing has been done along this line up to date. The basis for rating and indicating possible ways in the solution of the problem are pointed out in the works of N. A. Naumov (1923), after which from 1927-1930, the methodology of rating underlies a detailed planning of application to various plants and ways of their diseases (T.D. Strakhov and others) and starts to penetrate into production. Further stages of development of this matter - the organization of Record Section of OBV (ОБВ) (Organization of Pest Control) and then the rating of VIZR (ВИЗР) (All-Union Institute of Plant Protection). At the present time, as is known, the functions of recording diseases are transferred to all scientific research institutions of NKZ (НКЗ) (Peoples Commissariat of Agriculture) and VASKhNIL (ВАСХНИЛ) (Lenin All-Union Academy of Agricultural Science).

In connection with the development of control for the quality of agricultural products and for the increase of crops, there was organized a new direction of work, which received in our country a greater development than in any other countries, with the exception of a few (USA, Holland) and namely - the evaluation of seed material. In order to increase the quality of crops and thereby increase their quantity, to strengthen the achieved progress, sufficient clarity is necessary in the problem of determining the quality of grains, of sowing material, in addition to efficient guidance and to other organizational conditions.

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It is important that the quality of the crop obtained in many instances depends on the quality of the seed material used. The matter does not limit itself by creation of norms, but along with the indication of the seed quality (or the seeds of some agricultural plants) the producer, the control stations and the consumer must possess the method of appraisal of the quality of the products. The research work developed led to the working out of a methodology, applied to the appraisal of seeds, which provides the possibility of discovery of parasites in various forms - as surface contaminators or as cause of interior infection (G.N. Dorogin, A. P. Budrin).

The past twenty year period in the development of phytopathology is characterized by the tendency to use, in addition to direct methods of disease or stimulant control, such plant peculiarities which could resist the development of parasite organisms within or on the surface. The study of the essence and of the causes for immunity, as well of other kinds of manifestation of immunity and especially, if it leads us to its direct application in practice should be considered as most perspective tendency which, if successfully fulfilled, frees agriculture from the application of expensive and massive measures like the chemical control method and of others. The progress of Soviet science in this direction is obvious. A series of experimental investigations led to fixing of the physiological essence of immunity (Oparin, K. T. Sukhorukov etc.); during the last Five Year Plan work is done on the elucidation as to the role of albumen in plants in creation of resistance, and also as to the possibility of using these qualities of albumen in evaluation of selective immunity of plants in relationship to fungi, bacterial and virus diseases (T.I. Fedotova). In 1935, there was published the abstract of the academician N. I. Vavilov, summarizing the world experiment of study of plant immunity in the field.

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The last Five Year Plan is characterized by the increase of interest in the problem of the existence of an acquired immunity within the plants. Although the assertion that there does not exist any acquired immunity within plants, as is the case with human beings and animals, is irrefutable (namely, plants don't have general protecting resistance against the penetration and the development of the parasite, but only the local resistance which does not surpass the cell or which does limit itself to some group of cells), nevertheless the interest in this field of science should be considered justified, since in case of a corresponding methodology one could expect the application of immunity in practice. Thus, if the artificial immunization of plants is still not a settled problem, further efforts in this direction are necessary and the work has to be extended (Dr. A. V. Kaliaev).

The problem of artificial chemical immunization which originated in the pre-revolutionary epoch and which is closely related to the above, was renewed frequently in later years at various times and with various approaches (N. A. Naumov in VIZR (ВИЗР) (All-Union Institute of Plant Protection) "biotization" of seeds by Dr. Spielman) and at the present time acquires a new interest in connection with the information obtained recently on the progress of Gassner in the matter of creating resistance against rust in grains.

The greatest problem in socialist plant growth of changes of species received due attention on the part of phytopathology. The material accumulated for a long period of time on the evaluation of cultivated plants in respect to parasites may and should be utilized in arriving at a decision of the question on the best assortment of species in all domains of plant growth.

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The standardization of species without consideration of the degree of subjection of plants to diseases is unthinkable. This question in the domain of agronomy (resistance of grain in respect to rust and to smut, partly fusariosa and some other diseases, flax - in relation to rust, potatoes - in relation to phytophora, bacteriosis) vegetable growth (cabbage and its relationship to hernia ("kila") and partly to other diseases, carrots etc.) and also in the field of cotton (in respect to cotton wilt).

The degree of resistance of various species in the field of berries and in other domains is rated, where the problems of change of species are not so noticeable. The standardization and regionalization of species are carried out in rating the regionalization of diseases themselves. During the last twenty years a great amount of material has accumulated on this last problem, but this material is still not in a systematic order, and is incomplete; thus, we have only general information as to the group of rust, which is the most widely spread parasite of grain. We have started to obtain detailed data on the distribution of various kinds of rust in the USSR only recently.

Such is the condition of the utilization of assorted characteristics connected with their immunity to diseases. Such qualities, however, as it well known, could in some degree, often quite significantly, vary in respect to conditions of growth of those plants. Therefore, all the circumstances connected with the change of plant quality in relation to conditions of environment (the quality of soil and of fertilization, the peculiarities of predecessors, the significance of sowing time and of harvesting) have been studied in detail; T.D. Strakhov was the pioneer in this work.

The association of phytopathology with agrotechnique could be characterized as quite a close one at any rate, while working out measures of control of various diseases, the phytopathologists, as a rule, not only agree with the results of the agrotechnicians, but also strive to bring the control measures recommended by them into a system, which is in some degree based on the utilization of methods and of procedures of agrotechnique. There is no special necessity for illustration of such examples; they are quite general, having the same application in the case of almost all diseases.

The status of control of diseases for the past twenty years is characterised also by recognition of active, direct control measures directed against the destruction of corresponding parasites or for the weakening of their development. In this, with present knowledge and technical equipment, one can not forecast any conflict between agrotechnical and chemical (as well as physical) control methods.

One of the most characteristic occurrences which is so typical for our epoch was the tendency of replacing the method of sprinkling the plants by the dusting method, based on the great effectiveness and on the availability of the same. A natural result of the development of such a system could be the widening of the sphere of material applied for dusting. Thus, immediately following the classical method - by sulfur, sulfur preparations (ultra-sulfur of various kinds, some sulfur concentrate etc.) were used by the phytopathologist; in some instances, excellent results were obtained by applying powder AB (in the control of phytophtora on potatoes, mildew on grapes).

The work in applying chemical measures of control has been done by decreasing the doses (formalin, cupric preparatuses), and wherever it was possible, the replacement of scarce preparatuses by those more available; thus, copper for fungicides was substituted for by polisulfides, soap, tar, and mineral oil, formalin - by compound of aldehydes and high alcohols, which are known under the common name "release of synthetic rubber". Some of these substances are used in industry.

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Finally, a significant step forward in the field of the Chemical method is the rejection of empirical methods of selection of toxicity and of ingredients in mordants and in its composition for spraying its replacing by theoretically founded methods of work (I. M. Poliakov); in this way it was possible to prepare some preparatuses based on improved fluosilicite sodium, tar, etc., after having obtained successful coordination of toxicity and adherence of preparatuses.

Parallel to the development of work in the field of the chemical method, there is noticeable a considerable shift in the field of mechanizing the control methods. If in prerevolutionary time we knew very little about any special machines, which were used in plant control (the entire assortment of machines at that time consisted of kit and horse sprinklers of foreign origin and 1-2 machines for cleansing of grain, which were fabricated in prerevolutionary Russia by domestic or semi-domestic method), already the first decade of Soviet Russia is exemplified by mass production of most simple apparatuses, and immediately afterwards the construction of new powerful machines as well.

Now we possess a great number of machines which differ not only in their power and in the type of energy used (horse, horse-motorized, automobile, tractor) but in their entire purpose; thus, there are sprinklers, dusters and other machines, which serve cotton growing, grain raising, gardening, sugar-beet growing, parks, etc. It is worth while to note the large selection of mordant machines (constructed by A. I. Borggardt and others). Parallel to the increase of the application of surface apparatus there is noticeable the introduction into agriculture of the practice of the aviomethod, with the usage of dustlike, later - cloud-like preparatuses.

The utilization of the chemical method for control of infections in soil consolidated in practice, in spite of the fact that by the extermination of various organisms this method is considered effective and profitable; the matter did not go farther than quite numerous attempts in control of bacterial diseases (root cancer, polypody of fruit trees) and with some mushroom diseases in protected land, with promising success.

The application of thermal method of control limited itself in phytopathology to only one case - the heating of grain with the purpose of controlling mycelium of dusty smut of wheat and barley. The classic variation of this method was replaced by a wet process which obtained entirely new, specific form in application of Soviet large scale economy (N. I. Khodakovskii, also I. G. Chaiko and others), the thermic dry method began to be used and to come into practice theoretically and by laboratory means.

Enumerating here the basic methods of controlling bacterial plant diseases which were used during the first 20 years of existence of the Soviet land, one should not fail to mention the organization in the USSR (CCCP) of the quarantine service, which existed from 1931 according to the decisions of the Collegium of NKZ (HK3) People's Commisiariat of Agriculture of the USSR of June 5 of the same year. According to the decision of SNK (CHK) (Council of People's Commissars) of USSR of November 20, 1934, a special section for exterior and interior quarantine has been organized at NKZUSSR (HK3CCCP) (People's Commissariat of Agriculture) whose responsibility it is the working out of conditions, rules and instructions on quarantine, study of the subjects for quarantine, and also the systems of international quarantine measures, the fixing of quarantine division of the territory of USSR, the fixing of measures according to separate regions and points etc. Due to the timely organization of quarantine service, plant growing in the Soviet Union was able to be protected from the import of such dangerous disease as potato canker and many other analogous diseases in the degree of their importance. In respect to separate plants there were at hand some other earlier formulation (prohibition, based on the decision of the Soviet of People's Commissars of February 24, 1925, of import of potatoes from abroad without the agreement with the People's Commisariat of Agriculture of the corresponding Union's republics).

As to the diseases themselves, as subjects of the phytopathologist's work, during the last 20 years the main subjects of study and control were the following diseases.

1. Rust of grains. Only during Soviet regime was due attention paid to this most important group of diseases, under the general term "rust". First of all the work was given a corresponding scale, very important and numerous scientific research institutions were attracted to it, as for instance the VASKHNIL (ВАСХНИЛ) Lenin All-Union Academy of Agricultural Science, also scientific research institutions of principal administrations People's Commissariat of Agriculture, many points of network of VIZR (ВИЗР)All Union Institute of Plant Protection and others. As basic tendencies in work are the following: Injury of rust, determination of its aspects, resistance of some species of grain, fixing of the genus composite of grains with the appraisal of its significance and the development bio-ecological properties of separate genera, appraisal of the significance of agrotechnical measures, searching for and evaluation of powder-like fungicides for the control of rust by surface means and with the introduction of the aviomethod.

The harmfulness of rust as a whole is obvious, nevertheless there was no clarity on this question, whether one should look into it from the point of view of separate plants (some date were given only on wheat and some on oats) on separate kinds of rust, on races and on geographical regions. The work accomplished along this line not only explains the peculiarities of the parasitising of red rust of wheat on the species of Krasnodarka and Ukrainka, yellow rust - on the species of Kooperatorko and Kanred X Fulkmaster 266287 and stalky - on the species of Krasnodarka, but appears to be as a methodological management in the appraisal of such harmfulness in two different variations. Finally, the appraisal of separate races of red rust of wheat, as carried out at VIZR (ВИЗР) (Malchenko), showed the existence of different control of some races upon wheat plant in the range of the same parasite.

The division of each of the six kinds of rust, which parasitize on grains, is the task of today, and the work in this direction has to be completed in the next year or two. The difficulty and duration in accomplishing this division is due to the irregularity of the development of rust in different years and regions, which is explained by the great influence of external conditions - weather etc. - upon these parasites (M. K. Khokhriakov).

In the division which aims towards the evaluation of the resistance of some species of grains to rust, data were acquired which include separate species, standard and perspective (Ermenkov), all botanical species of wheat (Mashevskaia). The methodical side of the matter was worked out on Charkov Oblast Agricultural Experiment Station, in Odessa-Selection-Genetic Institute. The following stations dealt with the phytopathological evaluation of kinds and of lines of winter wheat in relationship to their resistance to rust: Chernigov Agricultural Experiment Station, Smolensk Oblast Experiment Station, Krasnodarsk Selection Experiment Station and others.

Investigations on this division and also on the following as work of the phytopathologist and selector should be considered as of special significance at the present time; they in the end lead us not only to the rational utilization of existing immune species, but also to the expedient selection of parent-pairs in the creation of new species, which differ in their higher degree of immunity.

The research work for the purpose of fixing the racial component of various species of rust was carried on in conformity with various regions (Petrushova-Leningrad Oblast, Pronicheva-Krasnodarsk territory, Geshele Odessa Oblast, Burov-Kazahkstan, Gorlenko-Voronezh Oblast etc., the spreading of races on the territory of USSR - Barmenkov). Besides, as a new circumstance appeared the inclusion in the subject of the question on physiological peculiarities of races of brown rust, their ecological peculiarities (Stepanov, Goriachev, Markhasev), problems of field ecology (Fedorinchik), of methodical problems, as for instance, establishment of optimal conditions for storage of spore material during winter (Kharkov Oblast Agricultural Experiment Station) etc. Unfortunately, the very extent of this problem did not permit the inclusion of the working out of such essentially important questions, like the comparative relationship of various races to poison, determination of the degree of resistance of races and many others, which will be included partly in the plan for further work.

Considerable attention was given to the significance of the agrotechnical method of rust control. The parasites of this group, strictly subordinated to the conditions of environment during their development react quite noticeably to the varied conditions of cultivation of corresponding plants. Thus, the appraisal of the significance of terms of sowing, the fertilizers used, the depth and time of plowing, and also of many other analogous circumstances was studied recently in connection with a whole sseries of points - in Leningrad Oblast (Maklakova), Kuibyshev Territory Experiment Agricultural Station, on Ulianov Experiment Field,

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by Donetsk Oblast Experiment Station on agriculture, Kharkov Agricultural Experiment Station, Chernigov Experiment Station, Ukrainian Institute of Grain Economy, Kazakhstan Institute of Agriculture and many others.

For that period of time until there will be not enough species immune to rust suitable for cultivation in various climatic regions of the USSR the agrotechnical methods and the chemical control method will play a significant role.

In the field of the chemical control method there were a few achievements (appraisal of new preparations, the testing of new control methods by means of applying salt - Ukrainian Institute of Grain Economy, Krasnodarsk Selectional Experiment Station, works of Westsibirian Territory Station of Plant Protection and others); nevertheless there was no synthesis of our knowledge along this line, and a definite judgement on the value of chemical method, its fitness, effectiveness and advantage is hoped to be attained in the near future.

The situation with rust appears to be as follows: its harm has not been eradicated but all the premises for a successful accomplishment of the problem are at hand; the results of world experiment on the study of rust and its control were assimilated (a monographic summary on this topic was published in 1939) the experimental work was adjusted and, if we can not say that a completed system of measures was created, still this last problem could be considered as solved as there has been prepared an instruction (composed to replace the previous one) which after its publication should be utilized in agricultural production.

2. Smut. In the degree of its significance this problem differs little from the preceding. Neverthless, with one exception, the practical work on the liquidation of smut injury, taking into consideration the biological peculiarities or parasites and all the achievements of phytopathological science, should be considered easier beyond comparison.

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As important for study are 11 - 12 kinds of smut fungi; not all of them have the same significance as to the degree of their spreading and the degree of their injury. The research work for the last two decades was carried on mainly in the direction of check-up and the completion of technique and methods of control, as the biological foundation for it was laid firmly even before. Only some details, which remained in obscurity, as some winter crops of separate species (T. D. Strakhov), elucidation of conditions for the growth of parasite spores (I. V. Novopokrovskii, B. I.Lobik and others), peculiarities of behavior of the mycelium type of dusty smut in grain (S. T. Bubentsov, S. S. Skvortsov), the existence of races in smut (M. F. Markova, L. S. Gutner, S. P. Sybina), required additional investigations, basically the work has been carried out on the determination of chemical measures of smut control. It is quite difficult to give the list of the authors working on this problem; the number of poisons under experimentation for the 20-year period is very high. Here it is only necessary to mention the work along this line of the inventors A. I. Borggardt, P. N. Davidov, who suggested the new preparatus "protars," or PD of the Institute of insecto-fungicides, which enriched the assortment of poisons for smut control by a whole series of valuable apparatuses (talkarsin, nivarsin, soviet germisan, etc.), and finally, a considerable series of inventors and investigators, who introduced improvement in the technique of poisoning sowing material.

Practically up to date the situation of control of wet smut of wheat (partly with the smut of oats and other grains) is depicted in the following manner. The chemical method of controlling smut , particularly the method of wet disinfection of grains, is considered accessible, effective, profitable and promising for the future, and also widely used at the same time; we make good application of some improved methods of utilizing formalin and other dissolved fungicides (half-dry method) borrowed from foreign practice; in connection with wheat smut the dry method of disinfection of grain is comparable in its effectiveness (but surpasses them as to accessibility of application) with these two methods. The gas method of utilizing hydrogen sulphide, other volatile gaseous substances just being worked out and has not as yet come into practice. The method of creating and of spreading resistant species in relation to smut, in comparison to chemical method is superseded. Agrotechnical measures bring essential benefit.

The thermic method for controlling two special kinds of smut which harms the tissue of wheat and barley seeds is considered the only acceptable at the present time (see above).

All these methods are effective in such degree and (with the exception of the thermic) so simple that their thorough and conscientious application, by utilizing valuable chemicals, should attain a full extermination of smut injury.

3. The Problem of Fusariosa. Attention to this problem was given some time before the Great October Socialist Revolution, but only 7 - 8 years ago it received full recognition as a great problem. The basis for it is the growing number of observations which indicate that the fungi of Fusarium type are not only considerably spread on a large quantity of plants (grain, meadow cereals, soy-beans, liupin (Leguminosae), peas and many other bean plants, cotton, flax, other textile plants, tobacco,

sweet potatoes, potatoes, tomatoes, cabbage, squash, lily family, coniferous and many other fruit bearing trees, rubber bearing trees and many others), but also are very harmful. On grain alone (cereals) there are known 4-5 species of plant disease, the physiological reaction of the parasite does not limit itself to the influence on the affected plant, but often spreads itself also on the organism ofman and of domestic animals.

In recent time some suppositions were expressed (E. S. Nasarov) that fungi of Fusarium kind could be direct parasites of man. It is quite natural that on account of that these fungi underwent a wide and detailed study, from the point of view of morphology and systematics, which is by the way very complicated (A. I. Raillo), and also in the direction of physiology, specialization and significance in the quality of parasites of separate plants. Measures in controlling it are determined from domain of agrotechnical (S. M. Tupenevich), thermic and chemical methods (M. C. Dunin - basis of chemical drying of coy bean seeds application of the thermic method).

4. The Problem of Bacterioses grew to its full size in our land only after the Great October Socialist Revolution. There were for this the same reasons as in connection with the problem of fusarioses, but, in distinction from the latter it has not acquired up to date an equal full and definite solution. Meanwhile, the number of very important plants affected by the bacteria is very great (cereals, cotton, flax, all vegetable plants, potatoes, many numberous fruit bearing plants, tobacco, sweet potatoes and many others).

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As it was disclosed at the study of these phenomena, foreign experience has in this case only a relative significance, since many of these diseases develop only in our country. Much has to be done along these lines on the seeming composition of parasites and on the detailed study of separate diseases for the foundation of measures of controlling them.

Of all the achievements one could record the detailed study of bacterioses of sugar beets and of tomatoes (G. K. Burgvits), tobacco (D. L. Tverskoi, L. I. Kokhanovskaia, V. I. Vsorov), clover (I. P. Zhavoronkov), cucumbers (P. M. Galachian), many general questions of bacteriological diseases of plants (B. P. Israelskii).

5. <u>The Problem of Virus Diseases.</u> According to the number of affected plants and according to the degree of its harmfulness virus diseases do not yield to bacteriological diseases. In the study of this problem we were, especially during the first years of work development, under the influence of foreign authorities, and only in the last 5 - 6 years its research went on independently and was followed by essential achievements along the diagnostic (the drop method of M. S. Dunin) theoretical constructions, (V. L. Ryzhkov) the study of separate diseases (S. B. Gorbani, I. K. Korachevskii, and others). Representing the part of general biological problem, the virus diseases of plants will not be able to be studied separately from corresponding diseases of animals and man.

6. <u>The Problem of Controlling Parasites from Flower Plants.</u> Dodder, and expecially broom rape are the widest spread parasites of many valuable plants, such as sunflower, tobacco, hemp, many vegetable and melon type plants, flax, clover, etc. In spite of the evident and significant

harmfulness to these plants they did not acquire due attention before the revolution. The past two decades brought about considerable shifting in this domain. Research work embraced the following divisions: the study of the physiology of seed growing (academician A. A. Rikhter, O. A. Valter, and L. M. Pinevich, D. L. Tverskoi and A. P. Parievskaia), further - elucidation of the causes of immunity of some sorts (academician A. A. Rikhter with associates), great selection work on the creation of immune varieties disclosure of existence with Orobanche cumana of two different races - Voronezh and Don, or so called forms a. and b. The first one appeared to be dangerous not for all sorts of sunflower, while the degree of parasitism and virulence of the second is much higher so far as the known selection types were affected intensively. Further work on creation of immune varieties was crowned also with success in respect to this Don race (L. A. Zhdanov).

7. <u>The problem of new diseases.</u> Without having dwelt in detailed manner on numerous other practical problems, connected with the development of fungus, bacterial and many other diseases upon numerous plants, it is necessary to emphasize here the whole importance of opportune disclosure and of study of such diseases which could be correctly considered as new to the territory of the Soviet Union. Among such quite numerous fungi, bacterial and virus diseases discovered in our country during the last 10-15 years, the list of which we are giving here: twisting of cotton leaves (virus disease), catalepsy of tomatoes, smut of wheat stalk, barley smut (2 kinds), false parasitic fungus of hops, disease "pasmo"

on flax, antracnose of rye, blackening of cotton fibers, Javanese decay of sweet potatoes, ascochyta on flax, bacterial canker of tomatoes, sooty fungi on apple trees, bacterioses of wheat (blackening of lamella), elm branch withering.

Causes which bring about the appearance of these diseases are not clear in all cases. In respect to a series of cases one may suppose that they were present in our territory before, but were not disclosed at the opportune moment, until more detailed observations indicated their existence (anthracnose of rye, blackening of cotton, ascochyta on flax, disease of hops, wheat batteries).

In respect to another group one may, without doubt, mention the introduction ("pasmo" on flax, elm branches disease, bacterial canker on tomatoes, Javanese decay on sweet potatoes). The origin of cotton leaves twisting, which shortly after its disclosure in our country was observed in Sudan, is not quite clear. The sooty fungus on apple trees became known in the twenties in England and in France, where it was absent before. Tomato "stolbur" is known only in our country and it seems to represent an entirely new phenomenon.

For the majority of the indicated diseases the biology of their stimulant is quite clear and control measures could be considered as determined; many of them were opportunely included in the lists of quarrantine diseases. All this could serve as a guaranty that the practical work of controlling them will bring the extermination of these diseases which in many cases has been done.

Nevertheless all these cases, as well as numerous other cases, known in the history of phytopathology, indicate that one should be cautious of the appearance of some disease at any moment, and that forces us to be vigilant and ready to meet every new enemy of our agricultural plants fully armed by knowledge and technical preparedness.

In the conclusion of this survey of the basic problems it is necessary to mention the ways and methods of the investigating work which during the research epoch appeared to be successful.

Here first of all it is necessary to emphasize the significance of investigation on the system and biology of parasite fungi. Soviet mycology has quite numerous achievements in respect to the systematization and biology of parasite fungi. It is sufficient to mention the investigations of V. A. Transhel and L. I. Kursanov in respect to rust fungi, numerous investigations of A. A. Iachevskii of a great number of various fungi, K. E. Murashkinskiii, B. P. Karakulin, A. S. and V. N. Bondartsevii, N. I. Vasilievskii, A. I. Lobik, S. Iu-Shembel, L. A. Kanchaveli, P. I. Nagornyi, I. G. Zaprometov, Iu. N. Voronov, N. N. Voronikhin, and many others who enriched mycology by information on new types, kinds and families of fungi and who assisted in elucidating many complicated questions of systematization and biology of these organisms. All this brings up the possibility of recognizing parasite types of plants, discriminate in their diversity (there are about 80,000 fungi, not less than a third of those are of parasite type) and, finally, to give them a corresponding evaluation.

Of quite great practical significance could be the mycological observations expanded widely in the last twenty years which aim to expose the composite of fungi as applied to various territories. Such observations carried out usually on a wide scale, including all fungi characteristic for respective locations, furnish material for the determination of the kind of fungi and in what quantity they are represented and whether there exists any danger for agricultural plants on the part of widely growing flora which is often affected by the same parasites. In a short survey it is quite impossible to enumerate all the collectors with the indication of the observed regions, so wide is the work carried out in this direction; it is sufficient to mention that newly acquired territories underwent this observation: Turksib - Lebedeva and Ermolaeva, Northern Ural, New Earth - A. A. Iachevskii; the latter considerably increased our information about fungi of the Arctic.

Finally, it is necessary to mention here in the way of most productive method of accumulating world experience and of transmission of knowledge the creation of summaries and of principal manuals. The twenty-year period of the existence of the Soviet state marked the creation and publication of many editions of exceptional importance among which one should mention the works of Prof. A. A. Iachevskii - monographs on "golosumchatii" fungi, "muchnistowsianii" fungi, his two world summaries "Foundations of Mycology" and "Bacterioses of Plants," further - the work of Prof. L. I. Kursanov "Mycology," Karakulin and Vasilievskii "Parasitic imperfect fungi" and many others.

In conclusion one should not overlook the fact that the development of phytopathology in USSR, this highly complex discipline, which required the collaboration of mycologists, selectioners, plant growers, agrotechnicians, chemists, engineer-constructors and others, moved with rapid tempo and gave definite results. If in some cases it has appeared to lag behind tasks of agricultural production, still it is impossible not to acknowledge that the leading branches of agriculture were served by phytopathology quite regularly. This has been indicated by the list of some systems of measures which were shifted (and partly are shifted) to production, which include: the system of measures in smut control, system of measures in potato-line, system of measures in sugar-beet line, system of measures in fruit-berry culture, system of measures in grape culture, system of measures in cotton culture, elements of system of measures in rust control in way of detailed instruction imparted for confirmation to People's Kommissariat of Agriculture of USSR.

May 4, 1951

(Transl. 119 Plant Protection)

Shchegolev, V. N.
Direction and methods of work to be adopted in dividing the territory of the USSR into regions after the distribution of pests and diseases. Zashch. Rast. 3:9-22. 1935 421 P942

Translated in full by
S. N. Monson

Characteristic of the majority of harmful insects, as well as of many diseases, is the drastic change in their quantities in separate regions, stages, and in individual years within the limits of any habitat.

These changes in quantity and the observed variation in dispersion depend basically upon the complex of different, inter-related changing factors and conditions of the surrounding environment that either suppress or stimulate the development of pests. The qualitative composition and biocoenosis of flora and fauna change, depending upon the nature of the habitat. Even in years of mass pest propagation, their number is far from alike on different plots. Every species propagates more frequently and strongly under conditions of habitat that are favorable to its development.

In the past years the idea concerning the necessity of detailed study of problems of distribution of harmful insects and diseases on the territory of the USSR, or the so-called "entomo-and phyto-regionalization", gained a stronger footholds among workers in the field of plant protection. We possess nevertheless, very few studies on the regionalization of pests, while the number of published studies on the subject is practically nil.

There is, moreover, much vagueness in the interpretation of the term itself. Different people interpret the term "regionalization" differently, providing it with an implication that varies in scope, range and direction. Aims and the methodological research on regionalization have not been made sufficiently clear.

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Actually, work on entomo-regionalization, though unorganized, was conducted by a fairly large number of organizations. ZIN(ЗИН), under an assignment of VASKHNIL(ВАСХНИЛ); of the Academy of Science produced a series of studies on the regionalization of harmful insects; regionalization of a series of multi-poisonous pests was put into effect at several sectors of VIZRa; problems of regionalization were set up as among the major tasks of the Sector of the Record Service of VIZRa, renamed the "Sector of Record and Regionalization". Our local organizations within the system of VIZRa, as well as within the systems of specialized institutes approached problems of regionalization as closely, and some of them, such as VNIS (ВНИС) have already begun work in this field.

All this tends to indicate that the problem of regionalization is fully ripe and that its solution demands practical application. In one of our articles (Shchegolev, V. N. "Concerning Systems of Measures", Zbornik of Vizra No. 6, 1933), we already stressed that problems of regionalization, the establishment of areas of distribution and danger zones are major links in the structure of any system.

It is necessary to point out that compared to other scientific disciplines, entorology and phytopathology are considerably retarded with respect to regionalization. Thus plant growers for instance, already possess botanical maps; as a result of the work of the academician N. I. Vavilov, centers of origin of the most important plants have been established; summaries providing charts on the distribution and varietal regionalization of crops are available (Wolf). Among entomologists and phytopathologists, however, work on regionalization has remained in the initial stage of development, and many subjects still require preliminary inventory and gathering of factual data.

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There is no doubt that in regionalizing harmful insects and diseases we shall confront enormous difficulties which in large measure depend upon an extreme diversity of species, movement of insects, and radical changes in their numbers, depending upon natural environments and agricultural conditions. Nevertheless, we are already obtaining first variants on regionalization from data accumulated on several subjects. In any event, the work has reached the state of ripeness and entomo- and phyto-regionalization has become a subject of great scientific and practical interest.

In this connection a special subject on "Ecological-economic regionalization of the territory of the USSR with respect to agricultural pests and diseases" was for the first time included into the plan of work of VIZRa (ВИЗРа) in 1935.

Its execution is conducted at sectors and laboratories connected with VIZRa. Twenty-four scientific workers were drawn into the work of regionalization.

In 1935 regionalization was started on the following subjects:

1. winter cutworm moths, [Agrotis segetum Schiff]
2. beet webworm, [Loxostege sticticalis L.]
3. complex of species of wireworms(click beetles), [Elateridae]
4. Marocco locust, [Dociostaurus maroccanus Thnbg]
5. grasshopper, [Caliptanus italicus L.]
6. Asiatic locust, [Locusta migratoria L.]
7. Hessea fly, [Mayetrola destructor Say]
8. Swedish fly, [Oscinosoma frit L.]
9. May beetle, cockchafer ("maiskii khrushch")
10. San Jose scale, [Aspidiotus perniciosus Comst.]

11. codling moth, [Carpocapsa pomonella L.]
12. brown-tail moth, [Nygmia phaeorrhoea]
13. pierid butterfly, [Aporia crataegi L.]
14. cabbage maggot, [Hylemyia brassicae(Bouche)]
15. complex of "naked" slugs
16. complex of species of ground squirrels
17. Claviceps purpurea(?)of rye
18. loose smut of cereals, [Ustilago]
19. some species of rust [Puccinia] of cereal crops
20. gummosis of cotton, [Bacterium malvacearum]
21. flax rust, [Melampsora lini(Pers.)]

As in any new work we expect to face considerable difficulties with regard to methods of work. The latter will for the most part be developed in the process of the work and questions of method actually formulated depending upon the results achieved.

In this article we briefly refer to data concerning the direction, methods and organization of future work on regionalization in the form in which we see it. In placing the article in "order of discussion," we hope for a response from different locations; the result may produce a correct line for succeeding study with regard to direction and organization of the work on regionalization.

AIMS AND TASKS IN REGIONALIZATION

Before discussing methods and organization of regionalization, it is necessary to dwell upon and mention the aims and tasks which should be met with regard to regionalization. Usually the term "regionalization" is interpreted as the establishment of an association of some object or method with a definite territory(region), accepted in an ecolgical and not adminstrative sense.

The concrete task of regionalization with respect to harmful insects and diseases consists in:

a). Determining the area of distribution(of one species or their complexes); i.e. the establishment of a territory where the specific species is found in any number;

b). Determining within the limits of the area of distribution of so-called "harmful zones", i.e. plots distinguished by different numerical prevalence of a species, a different frequency of their mass appearance or a different significance of a species with regard to the degree of their harmfulness, and the amount of losses;

c). The establishment of the causal link between the distribution of a species and the historical, ecological and economic conditions of a particular environment.

The final purpose of the study of regionalization, from a practical viewpoint, consists in:

a). the establishment and proper organization of an internal quarantine.

b). consultatory work on varietal regionalization of agricultural crops;

c). the establishment of a basis for some agro-technical methods (periods of sowing; dosages and forms of fertilizers, crop rotation, etc.);

d). the provision of base stations for recording losses from harmful insects and diseases.

In the final result, a properly established and widely maintained procedure on regionalization, following a detailed analysis of causes and factors, which determine regularity in the distribution of pests and diseases, will undoubtedly lead to a planned regulating of biocoenosis and the elimination of some pests from areas in which they settle.

The establishment of boundaries in an area of distribution and particularly in danger zones will, no doubt, also aid the faster solution of the problem of mass propagation of insects. The work of recording the influence of individual factors which, as a rule, appear most drastically on the boundaries of danger and unstable zones, where the dynamics of a species are particularly subjected to severe fluctuations, will be considerable aided by the establishment of boundaries of areas and danger zones.

The solution of the most important practical problems arising in connection with regionalization may be achieved only in the event of a deeper ecological-economic analysis and specifically by establishing the relative role of all complicated and manifold factors which affect the territorial distribution of insects and the "topography of a species" in the process of its historical development.

We believe that attempts to establish a basis for regionalization on short-term records (3 to 4 years), which indicate the relative significance of a species, without referring to the genesis of origin and danger zones, without obtaining a clear conception of the role of external factors and the reaction of the organism to them, will hardly be representative of an actual situation and not establish the causal dependency so important from a practical viewpoint. An inadequate analysis of the domplicated knot of factors which determine zonal distribution, the severance of the object under study from the entire biocoenosis may even produce a distorted picture.

In any event, observations over a short period of time and inadequate factual data on the dynamics of the propagation of species are not sufficient for the determination of danger zones. Short term observations may refer to periods of non-typical distribution in danger zones and produce errors and distortions in final conclusions concerning an actual situation.

The above difficulties are not to be interpreted in support of the claim that regionalization may not be conducted at present or that it may not be undertaken now. On the contrary, only after the work is begun one may expect to move it from its inactive stage and only in the process of work will it be possible to establish methods of procedure and fill the gaps demanding immediate additional study.

PLAN AND STAGES OF WORK

In each enterprise a plan and the proper sequence of separate research operations carry enormous significance. We maintain that the work on regionalization should proceed in the following order:

1. Accumulation of primary factual data on the static and dynamics of pests in a regional-ecological cross-section.
2. Selection and/systematization ~~systematization~~ of accumulated data on the establishment of areas of distribution and the segregation of danger zones.
3. Compilation of working maps designating areas of distribution and propagation of a species, and indicative danger zones.
4. Ecological-analytical and biocoenological(?) development(?) of indicators that determine changes in the dynamics of a species and its yearly cycle, as well as its potential and actual harmfulness.
5. Critical comparison of ecological-physiological indicators carrying factual data on the geography and topography of a species, as connected with the characteristics of an environment and economic factors.

6. Synthetic generalization and the building up of a theory on the regionalization of a species.
7. Additional studies and research, designed to aid the introduction and a more precise definition of the theory of regionalization of a species.
8. Formulation of maps on ecological regionalization of a species.
9. Compilation of an explanatory text for the map(glossary??).

Nor does this outline mention that each species will have to go through all regionalization stages in a compulsory order. To begin with, considerable detailed data has already been accumulated, with respect to some species, and certain stages of work have already been passed. In addition, there may be instances in the process of the work when at one of the stages study may be accelerated, outstripping another stage in time. We know of cases when the mere comparison of data concerning the actual distribution of a species with climatological and soil data permitted to obtain(at least in theory) necessary ecological indicators which characterized the dynamics of propagation of a species. Specifically, we may point to the work of the USA entomologist W. Cook, who by using the method of "climogramms"(?) succeeded in interpreting a series of ecological problems that explained the distribution of gnawing borers("podgryzauishchie sovki").

The fact that essential ecological indicators may be obtained by comparing the actual distribution of a species with the characteristics of an environment may be seen on the example of the Asiatic locust, [Locusta migratoria L.] and the cutworm moth, [Agrotis (Euxoa) segetum Schiff].

In the case of the cutworm moth, this was established by comparing the years of its mass propagation with the nature of meteorological conditions (Azov, 1928, Vladimirskaia, 1934), the connection between rainfall, June and July temperatures and the periods of pest propagation. In the northern zone of the area of distribution an increase in number of pests is observed in the first year, at July temperatures above 18°C and rainfalls of less than 50 mm. In years when the July temperature is lower than 18°C, there is a reduction in the number of cutworm moths.

With respect to the asiatic locust in the forest steppe, interesting corollaries determining the dynamics of propagation and distribution have been established by Predtechenskii (1930).

It seems that the isotherm at 13.6° in the months of April to September forms the northern boundary of focuses of mass propagation and danger areas for the asiatic locust. North of this boundary, despite the presence of fully suitable locations with regard to geo-botanics and soil conditions there was no mass propagation of the pest. In the south the danger area of the central-Russian focus reaches the boundary of the podzol forest zone. Within the limits of the black earth zone a small focus of locusts is located in a narrow strip along the river Voronezh, and here again it is dependent and related to light podzol sandy and sandy-loam soils.

The torn and disunited danger area within the borders of the chernozem belt, particularly in its eastern part, depends upon the irregular distribution of soil types and their physical composition which determine the difference of micro-climatic conditions. Sandy soils possessing considerable heat conductivity and moisture penetration and an insignificant heat capacity get heated faster and stronger, creating conditions that come closer to the optimum of development of [Locusta migratoria L.]. Predtechenskii in his studies cites several examples when in connection with the change in the physical composition of soils, (increase of small particles), the characteristics of the soil change also in an unfavorable manner for locust habitats. Clayey and argillalaceous soils prove particularly unfavorable.

The narrow borders of the ecological optimum of [Locusta migratoria L.] in the nonchernozem zone determine not only the territorial distribution of its sandy soils but also mass appearance. According to the most recent studies (Predtechenskii 1930) an increase in the number of pests is observed in years when the vegetative period is distinguished by a higher than standard temperature (13.8°) and a lower degree of rainfall, (below 320 mm). In years of lower temperature during the summer and fall months and increased rainfall, the number of pests in focuses is radically reduced. Temperatures above standard cause an earlier appearance of locusts, their flight comes earlier, and as a result, the period (during a warm autumn), necessary for the maturing of ovaries is prolonged and females are laying maximum numbers of eggs.

The dependence of the numerical amount of pests upon meteorological conditions during the vegetative period is so drastic that a genuine opportunity exists for a prognosis of the pest's appearance on the basis of ecological study.

Mass propagation of locusts in the non-chernozem zone in regions of permanent focuses may be expected following two years of favorable conditions for their development with regard to temperature and rainfall throughout a vegetative period.

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To make the prognosis of the nature of meteorological conditions more precise, the years are divided into

1. unfavorable years (temperature equal or below the usual average of 13.8°), while rainfall is above standard.

2. years slightly favorable, (mean temperature during vegetative period no higher than 1.5°)

3. favorable years (temperature during vegetative period 1.2 to 2.5° higher, and rainfall below average)

In accepting this definition (Predtechenskii, 1930) it is considered that mass propagation of locust will occur in the following combinations: 1, 3, 2; 1, 2, 3; 2, 3, 3, in the respective years.

With regard to naked slugs, research done by N. I. Vavilov established the connection between rainfall and temperatures of the summer-fall months and the mass appearance of the pests. The correlation between the habitat of slugs and relief, moisture of the soil and the nature of the vegetative layer was established.

By using the comparison method a series of dependencies in the distribution of wire worms has been established, depending upon the geography of soil types.m

The above examples which can be multiplied many times, indicate that ecological indicators may be obtained prior to laboratory work by comparing data on distribution and dynamics of injuries with the nature of ecological conditions.

While these comparisons confirm an indicated dependency, they frequently are unable to disclose the causal connection. In order to learn this it is necessary to undertake laboratory tests and by experimenting with histological, anatomical and physiological analyses establish the reaction of individual environments upon the viability, conduct, development, fertility and longevity of insects. These indicators aid considerably in the ecological regionalization of a species and make possible an explanation of the regularity of distribution. With regard to subjects accepted for regionalization in the plan of 1935, we possess extremely heterogeneous and most variegated ecological conditions.

As a result there prevails considerable difference with regard to periods and volume of executed work on individual subjects, which is unavoidable considering the limited degree of the present study.

With regard to subjects for which necessary material has already been accumulated on the static and dynamics of distribution and propagation, and where basic ecological indicators have been determined, permitting to disclose the causes that determine zones of distribution, there exists a real possibility for detailed regionalization even in 1935. Specifically, one may list among these subjects at least for the European parts of USSR: beet webworm, [Loxostege sticticalis L.]; migratory locust, [Locusta migratoria L.]; Marocco locust, [Dociostaurus maroccanus Thnbg.]; and cutworm, [Agrotis segetum Schiff].

On many subjects data has been accumulated describing only the area of their distribution and danger zones have been segregated within areas where the damage is more severely and frequently felt. Nevertheless, in the case of many species ecological indicators have not been studied adequately as yet, which makes it impossible to establish the causes that determine the distribution of a species. To achieve this additional ecological study is necessary, which should be passed on to central ecological laboratories and local organizations.

Finally, vor the third group, of least studied subjects, there is a lack of even sufficient detailed data characterizing the dynamics of numerality according to individual years and territories. With respect to this group, it is clearly possible to fulfill the first stage of the work in 1935, dealing primarily with the establishment of the area of distribution of the species.

The above adequately explains that the results of work on individual subjects vary considerable depending upon the amount devoted to their study and the availability of material.

The year 1935, as the first year in which organized work in regionalization was undertaken represents naturally a preliminary stage to the vast and prolonged work indicated by regionalization. The methods to be applied in regionalization are not sufficiently clarified and will be established and improved in the process of the work in 1935.

METHOD OF ESTABLISHING AREA OF DISTRIBUTION

Depending upon the nature of a studied species the method of its regionalization is changed correspondingly. It is not possible to refer here to a general pattern and every researcher should, by taking into consideration specific characteristics of a regionalized species, select a method sufficiently precise to ensure a better, clearer and faster solution of the entire problem of regionalization.

For purposes of maximal comparison of the material on regionalization and its utilization for subsequent generalizations, it is necessary, nevertheless, to point to some methods which should be maintained in the course of the work. Let us dwell upon those that are most important and, analyse them consecutively as they apply to stages of research previously established by us.

The first three stages of the work aim at establishing a general area of distribution of a species, the topography of a species ~~connected~~ in connection with the nature of the habitat and a division of the area into zones by giving consideration to the intensity of propagation and quantities of harmful species.

All data characterizing the statics and dynamics of a species should be collected and systematized for the purpose. Aside from literary and statistical data and that of the Record Service, data on fauna collected at the Zoological Institute of the Academy of Science should be used to determine the area of distribution of a species.

All places where a species is found should be marked on a map of prescribed scale. Precise verification of the material based on documented data is most important. It may be remembered that some old fauna material contains inaccurate data. All synonyms applicable to a species should be carefully understood since with respect to some subjects they are extremely confusing and in many instances have been radically changed. Specialists-systematicians on fauna and flora should be drawn into the work because without their participation a practical worker would frequently have difficulty in analyzing available material.

The designation of locations of a species by dots on maps will permit the drawing of general boundaries of an area by interpolation.

For purposes of reference, verification and accuracy it is advisable to place a number next to these dots and to list separately the sources (literary, collection, personal studies, etc.) on the basis of which a particular location is established.

It is necessary to distinguish between natural areas, occupied by insects, as a result of their active settlement of transfer by wind or water, and artificial areas, where settlement of an insect was accidental or deliberately made by man.

The boundaries of an area are, in other words, boundaries of the distribution of a species; they are dependent upon numerous and varied factors, frequently not upon any one of these but upon a complex of several factors, as well as upon the migratory ability of the most harmful insect. Among the most important factors that determine the boundaries of an area distribution are:

1. climatic factors (usually an aggregate of these);
2. physical obstacles (seas, straits, wide rivers, high mountains, large areas of forests, etc.);
3. competition of the part of other biologically related species;
4. the absence of definite conditons for settlement providing a complex of conditions necessary for the development and propagation of a species (of primary importance is the composition of vegetation for vegetative-poisonous species, composition and structure of the soil for "soil insects").

In addition to the above most important factors, existing boundaries of an area are frequently the result of changes that have occurred in previous years.

The zoologist STANCHINSKII (1922) proposed the following classification of boundaries for the distribution of species. To begin with, two groups of boundaries (static and transitory) should be distinguished. Static boundaries are those established in a former epoch. Transitory boundaries, as opposed to the latter, change visible under our eyes, i.e. species continue to spread within an area or, on the contrary, diminish in an area of distribution (progressive or regressive areas).

Within the limits of the above two groups it is necessary to distinguish between:

a). IMPEDED BOUNDARIES, possessing physical obstructions inaccessible to species. The criteria of established boundaries lies in the conformity of the area of distribution of a species with the boundary of an obstacle (sea, strait, wide rivers, high mountain peaks).

b). ESTABLISHED BOUNDARIES, determined by the abscnce of a complex of conditions essential for the development and propagation of the species. This type of boundary is most prevalent and is frequently met. Species that feed on some particular plant or are connected witha definite botanical association are evidently unable to spread when plant associations change. Species adapted to life under specific soils of definite composition, structure, moisture, etc., are apparently unable to develop on soils of another type. Thus the change in climatic conditions reacts upon the area of distribution of a species.

c). RIVAL BOUNDARIES are determined by the competition created by other, biologically related representative, substitute species which interfere with the settlement of a species in an area they occupy prompted by self-preservation. The establishment of rival boundaries of species presents considerable difficulties. Indicators of rival boundaries of a species are: absence of distinctive features in a location at the boundary of the distribution of a species, the overlapping of boundaries of two allied species, a pronounced increase in the number of specimens connected with the movement directed towards the center of the area occupied by the species.

d). RELIC BOUNDARIES, i.e. those formed a long time ago and. which at present cannot be explained by any of the above factors and conditions. Non-conformity of boundaries of an area with those of a definite location serves as an indication of this type of boundary; non-conformity with opposite boundaries of biologically related species, and absence of changes in boundaries. Relic boundaries indicate that combinations of ecological conditions existed a long time ago on a certain territory. Pictures of the distant past may occasionally be reproduced on the basis of these boundaries.

e). TRANSITORY BOUNDARIES in a narrow sense of the word do not depend upon changes in locations or competition of other species. These are cases where the settlement of species occurs before our eyes.

The above classification is, of course, tentative; there are no such drastic distinctions between individual groups of boundaries; instead there exist series of successive transitions. The above classification is nevertheless useful in the study of an area.

It is of utmost importance to establish the center of an area, i. e. the initial point from which the settlement of the species originated. Usually the determination of a center presents difficulty since it may only be established indirectly. For the most part the largest number of specimens is settled in the center area, the quantaties gradually diminishing in the direction of the periphery. The diversity and mutitude of forms and varieties of species serve indirectly also as indicators for a center area.

DETERMINATION OF DANGER ZONES

In the different parts of an area of distribution the abundance of a species and the frequency of its mass propagation are not similar. In this connection, the amount of damage caused to agricultural crops is equally dissimilar. It is therefore important to segregate (in regionalizin zones of distribution within an area) species distinct in economic significance, i.e. to regionalize from an economic standpoint, a procedure having particular significance for the correct planning of methods and the determination of losses.

In order to approach the problem of economic regionalization of a species accurately, it is necessary to:

a). gather and indicate on the map facts reflecting upon the volume and intensity of infection in different years.

b). establish the potential and actual degree of damage, emanating from the existive relationship between pest, plant, and environment (weather, soil, agricultural technique, periods of development of pest and critical phases in the development of the plant.)

c). mark the volume of damaged or destroyed plots, taking into consideration their intensity in different years.

Here the method of compiling a map is extremely important for it refers to the volume of damage or destruction offthe crop. It is by no means irrelevant which method is used for the purpose. The following methods are most frequently used: 1. cartograms; 2. carto-diagrams; The latter in turn vary between: a). dash lines; b). colored; c). dots; depending upon the method of application.

It is necessary to point out that the most customary dash-limed method is least satisfactory and wherever possible it is essential to use dotted cartograms.

In the former an established line (or coloring of varied intensity) is applied characterising an element of the species under study (percentage of damage, intensity of injury, size or percentage of destroyed crops). Moreover, lined diagrams severely shade the variegated area of injuries usually observed on different plots. The illusion of a uniform distribution of injury is created which hardly ever exists in reality.

For purposes of regionalization, wherever sufficiently large data indicating injury is available, the method of dotted maps should be used. This method, first applied in the USA in 1914, is receiving wide application at present and is used by our plant breeders in regionalizing crops. Dotted cartograms possess more clarity and offer a better understanding of the variation of the distribution of the damage and the economic significance of the pest.

In dotted cartograms a dot of established size serves as a fixed sign. This dot stands for the size of a studied factor or mass volume of distribution of the subject. For instance, one dot may equal a definite number of infected or destroyed hectares of plantings.

The size of the dot depends chiefly upon the scale of the map and should occupy the area designated in the arrangement. Let us suppose that we refer to degrees of damage on a map of which the scale is 10 km to 1 cm. In this case each square centimeter of the map will equal 100 square miles or 10.000 hectares. In using a dot for an area equalling 1 mm, it should stand for 1 square km or 100 hectares of destroyed planting. The density or thinning of dots represents vividly size and distribution of the injury. The smaller an administrative unit concerning which data is provided, the smaller the indicator signified by a dot, the more will the map reflect the actual distribution of damage.

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In cases where actual data concerning the volume of injury is limited or interrupted, it is of course, not possible to use the dot method and the line diagram method has to be used.

Irrespective of the method used for compiling maps, their comparison for successive years offers the opportunity for segregating danger zones within the limits of an area.

For the sake of convenience and uniformity in comparison one may accept the following subdivision of zones, depending upon the volume of insects within an area;

1. zone of constant danger
2. zone of unstable harmfulness
3. zone of limited damage.

This plan is however, not applicable to all species.

In the zone of constant danger the number of pests is usually greatest; here the pest accumulates in large quantities. Climatic and other ecological conditions of the zone frequently provide optimal or, in any event, favorable conditions for propagation and viability of a species.

The zone of unstable harmfulness. Under normal combinations of climatic conditions the pest does not appear in masses and its harmful activity is not apparent. It usually remains in a depressed state and its propagation is contained by unfavorable combinations of factors of the surrounding environment. In years when climatic conditions deviate from the usual in the direction of optimal conditions of development, we observe an acceleration of damage and an increase in the quantity of pests. Here also belong instances where damage results from flown-in pests, that migrated from their permanent reservations, i.e. zones of constant damage. In those cases, depending again upon a complex of conditions, the damage may either be severe (under optimal conditions contributing to the propagation of the species) or weak (under a minimum of conditions), or may not appear at all (lack of minimum conditions essential for their development).

Finally, in the third zone, that of limited damage, in spite of the usual presence of a species, no severe damage is ever observed. This zone does not produce the complex of conditions essential for pest propagation in appreciable quantities.

ECOLOGICAL BASIS FOR REGIONALIZATION

The preceding three stages of the work will result in a fixation of the existing situation established for the area of distribution and reflect upon the economic significance of a regionalized subject.

They do not reflect, however, the causal dependence between the nature of the location of distribution of the species, nor do they explain the reason for its localization on a definite territory, or provide data on the understanding of changes of the intensity in the volume of a species.

For a correct understanding and interpretation of causes that determine boundaries of an area of distribution and the ecological-economic stipulation of danger zones, it is essential to possess data on the:
a). influence of separate ecological factors upon the intensity of the propagation of species; (fertility, life span, seasonal cycle)

b). nutritional specialization and the role of nutrition for pest development and propagation.

c). influence of economic and agro-technical conditions upon degree of damage

d). methods and potential possibilities of settlement of species

The causal dependence may best be discovered where definite and detailed laboratory experiments are available that establish the optimum of the development of a species, clear up facts that affect more severely regionalized species and indicate physiological-anatomical and histological changes in the organism under the influence of environmental conditions.

Data may be obtained from ecological-biocoenological research which may present a fairly clear picture of the distribution of a species.

Similar laboratory work, is however not sufficiently developed with us a yet. Only in recent years our ecological laboratories have begun to analyze the influence of individual physical factors (chiefly temperature and moisture) upon harmful insects.

Ecological laboratory research may therefore be applied in only very few cases. Ecological Regionalization may at present be conducted chiefly by comparing factual data on the distribution of pests with ecological indicators. Equipped with maps of areas of pest distribution and having established the locations of most frequent and severe damage, it is necessary to compare these with a series of ecological indicators and on the basis of this comparison attempt to find an explanation of the peculiarities of the distribution of a species.

Depending upon the nature of the subject, the conditions of its development, the winter phase, etc., maps of distribution should be compared with geo-botanical and soil maps, data on meteorological conditions of a region or year (isohyetal, isotherm, isobar, hygro-thermic coefficients, the degree of snow cover, cloudiness, intensity of sun radiation, etc.). The comparison method of climograms should be widely used, since it establishes clearly the connection between pest and climate, and available maps and special climatological studies utilized. Depending upon the characteristics of a studied subject, ecological elements of one sort or another will prove of greater importance. For instance, for monophagous insects the area of forage plants will be of enormous significance in the matter of distribution. For species of low frost resistance isotherms of winter months, connected with the volume of snow cover will carry significance. Hygrophyte species will in their distribution be guided by moisture and rainfall. With regard to northern boundaries thermic conditions will be of considerable significance, specifically the possibility of completing the annual cycle and consequently the development on a given territory will depend upon the number of days with a temperature above the "point of development".

Occasionally the boundary of distribution of some species of plants (especially woody crops) serves as a good indicator for the distribution of a species. The plant, according to the phenologist Poggenpaul, serves as a "living thermometer" which reacts to the entire complex of surrounding conditions. It has been established, for instance, that in the West the boundaries of the zone of highest damage caused by the European corn borer [Pyrausta nubilalis Hb.] coincide with the Eastern boundary of the hornbeam. This correlation is understable since the hornbeam demands, as does the corn borer, increased moisture for its development.

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The establishment of correlation in the regionalization of pests or diseases with some indicators of the surrounding environment provides the basis for correcting the boundaries of an area and of danger zones and allows to fill-in gaps in mapping. The result of ecological comparison is the creation of a theory of the regionalization of species explaining the ecological-economic foundation of their distribution.

It is desirable to conduct special work on the verification and specification of this theory, specifically by:

a). laboratory and field studies which ascertain the influence of factors and disclose the causes of their actions

b). special investigation of boundaries of an area and zones of unstable harmfulness where the influence of external factors is particularly pronounced and drastic

c). special investigations of "white spots", i.e. sections which had remained undetermined in mapping

d). special investigation of locations of particular interest in view of their contrasting ecological indicators.

SUMMARY OF RESULTS AND FORMULATION OF WORK

In the summary of work on regionalization each species (or complex of related species) should be provided with a map upon which data characterizing the general area of distribution and danger zones is to be marked with dots or lines. The scale should be 1: 5 000 000.

The map should also refer to ecological indicators connected with zonal distribution.

It may, in addition to the map, which establishes the general ecological regionalization of a species, be desirable to provide maps of smaller scales, producing the world area of the distribution of a species, the topography of a species in individual localities, in connection with relief, micro-climatic conditions, the nature of vegetative layer, types of soil, etc. Necessary separate maps may be provided relative to dynamics and distribution in different years or according to crops, for mult-poisonous species.

Designations on all maps should be made with black India ink, which offers the opportunity to make prints without re-drawing.

A detailed explanatory text should accompany each map. This text indicates first of all the method used in regionalizing the species, lists the basic numerical data and provides a detailed explanation of those ecological dependencies established in the course of laboratory experimentation, or those obtained by comparison in the process of regionalization.

ORGANIZATION OF WORK

With regard to organization, the entire work of regionalization in 1935 shapes up as follows.

Specialists who in preceding years have concentrated on a subject included in the plan of regionalization are drafted for the corresponding divisions of the specific topic on regionalization. The work on regionalization is divided among corresponding sections, included in the plan of a sector or laboratory where an experimentor of a given section is at work. With respect to finances, all divisions on regionalization should, according to the ruling of the administration, ~~max~~ be supported within the organizational unit where the experimentor of the section dealing with a topic is engaged.

Shchegolév, V. N.

For the organizational-methodical guidance of the work the following sections have been established within the framework of VIZRa: a). the section on regionalization at SUR and b). the bureau of regionalization.

The section of regionalization which represents the basic organizational center has the task of: a).. organizing the work and controlling its execution by individual experimentors in respective sectors; b).- general methodical supervision over the work exercised by scientific supervisors on entomology (V. N. Shchegolev) and phyto-pathology (P. A. Proida); c). the organization of a business office on regionalization, assigned to accumulate basic data typical of the territory of the USSR with respect to soils, climates, and geo-botanical data. Taking into consideration the necessity of a differentiated approach to separate subjects in regionalization, the section may, naturally, not undertake detailing methods and limit its work to providing general directions and consultations essential for the creation of uniformity in methods.

With regard to material, the section equally proposes to collect only data necessary for general use.

Specific data on the ecology and climatology of regions should be collected directly by corresponding experimentors of the different sections.

The Bureau of regionalization represents a consultative body which has as its task:

a). consultation on problems of methods in regionalization

b). consultations on plans of work

c). review and approval of results of work on regionalization within separate sections.

Shchegolev, V. N.

A concrete plan on regionalization for 1935, indicating subjects, experimentors, periods of work, and stages of study; plans on special divisions of work, and individual plans of experimentors.

In evaluating the volume of the plan and the periods of contemplated work it is necessary to consider the exceptional difficulties we face with regard to the regionalization of pests and diseases.

It is necessary to point out that entomology, phytopathology and zoology are considerably retarded with respect to the inventory of fauna and flora, as compared to botanists-plant breeders, for instance, who deal with flowering plants. Only recently has ZIN begun work on the publication of the "FAUNA of USSR.

In addition, entomo-regionalization of the territory of the USSR represents considerable difficulty, since insects are mobile, capable of active migration and also subject to passive transportation over large distances by winds.

The presence of a radically expressed change in the quantity of insects, according to different periods of time and regions, in connection with changes of ecological conditions, as well as a considerable changeability in the damage caused, equally interferes with the segregation of danger zones and the economic regionalization of a species.

The above difficulties of the work and the accumulated data lead naturally to a considerable variation in volume and results of the work of regionalization on individual subjects. The year of 1935 should therefore rather be viewed as a year of preliminary work.

As a result of the work performed in 1935, experience and practice will be gained and accumulated, permitting the work of regionalization to develop on a larger scale in 1936, to include new subjects and assume zonal regionalization.

End of article

5/1/51

Pereviancheko, A.
Concerning one "system of measures" applied against meadow moth [beet webworm, Loxostege sticticalis L.]
Leningrad. Inst. Zasch. Rast. Sborn. 8:152-156. 1934 464.9 L542

Translated from the Russian
by S. E. Monson

The Soviet nation in the years of the first Five-Year Plan achieved decisive successes in establishing a socialist society under the leadership of the Communist Party, headed by its leader, comrade Stalin; it transformed the Soviet Union into a mighty industrial nation, the largest agricultural country in the world.

The first year of the Five-Year Plan brought new victories for socialist construction. Despite enormous difficulties created by Kulak interference in the field of agriculture within the past year, momentous achievements took place in 1933. Stalin's call to "transform all collective farms into bolshevist farms and make all collective farmers affluent" was accomplished in practice.

The Party achieved these decisive successes in agriculture under conditions of a violent class struggle with the remnants of the capitalist classes, by steadfastedly pursuing a industrialization policy of the country.

The struggle with kulaks in villages had its reflection in the ideological field. Advocates of the Kulak system, following the exposition and liquidation of counter-revolutionary organizations in agriculture (Kondrat'evshchina and others) turned to new forms of struggle, as evidenced

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in the counter-revolutionary group of Wolf-Slipanskii. They utilized scientific research organizations as tribunes for their counter-revolutionary purposes and for mobilizing the remnants of conquered capitalist classes.

Theoretical thought in agriculture should, according to comrade Stalin, keep in step with the development of socialist agriculture. It should be ahead of practice, lead the latter, and point the road to socialist victory to the practical worker. Scientific research organizations should strive towards the fulfillment of this task.

Theoretical work should be of a type the practical worker could utilize in his work. In dealing with a problem, the author should bear in mind that his conclusions result in actual benefits to industry and not let them be used by the class enemy for harmful purposes.

Some authors at VIZRa are unfortunately not endowed with this quality. Working in theoretical generalizations on the protection of plants from pests and diseases and in fulfilling tasks of enormous significance, as required by the Government and the Party in their aim to increase yields and control losses, VIZRa tolerates in its literary output entire series of considerable errors which in individual instances prove plainly damaging.

Issue number 6 of Zbornik of VIZRa for 1933 carries an article by Professor Znamenskii under the title "How to control the beet webworm, [Loxostege sticticalis]". Professor Znamenskii cites here a "System of Measures" for the control of the beet webworm which according to the introduction by the editor

Derevianchenko, A.

Zbornik, p. 11, is supposed to provide a theoretical basis for control methods and equip practitioners with active weapons for controlling this most dangerous pest which in individual years destroyed enormous areas of sugar beet plantings and other crops.

In the first part of his article Professor Znamenskii provides an economic premise for establishing measures and regionalization, i.e. he provides a regular basis for his proposed system. Let us see how the author succeeded in his task.

Professor Znamenskii proceeds from the premise that in the zone of sugar beet plantings, the beet webworm appears periodically, flying in from desert or part desert lands and steppe oblast(s) and that local ("Rezervatsii"), remainders, are of subordinate significance. He regards the inadequate utilization of virgin steppes and the limited measures of their utilization as tragical. Concentrating upon the zone of non-utilized steppes and part-steppes, distant from the zone of sugar beet plantings (where the beet webworm at present causes major damage), Professor Znamenskii leaves out completely the problem of "remainders" of theBeet webworm and conditions of its propagation in the steppes of the Ukraine, the Don, Lower Volga, and otherregions, i.e. areas immediately adjoining the zone of sugar beet plantations, from which the flight of the pest would most likely penetrate into zones of sugar beet fields; instead he barely refers to them in general terms.

The author interprets the extinction of a life stream (wave), caused by the "general oppressive factor relentlessly leading into one direction" by reduced quantities of the beet webworm, following outbreaks of mass

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XXXXXXXXXXXXXXXXXXXXXXX It is not at all clear what the author understands under an oppressive factor of "general significance". Observations of the beet webworm in sugar beet zones indicate that various specific causes lead to reduction in its quantity in different years, different combinations, and that a "general factor" was nowhere observed.

Somewhat further the author states that ecological conditions in some places contribute to the maintenance of mass propagation, while in others they serve to suppress the latter. It thus follows that climatic conditions, according to Znamenskii, create a "uniformity" in pest propagation for a prolonged period. It is difficult to estimate where the "depressing factor" comes in.

In explaining the disappearance of the pest by the action of a "general factor", comrade Znamenskii did not consider it necessary to dwell upon and to evaluate economic measures and give appraisal to control.

One of the most important factors, however, for the rapid reduction of XXXXquantities of beet webworms in sugar beet zones are the very mass measures designed to control it and the general system of practicing agriculture with a high percentage of stubble, fallow, deep plowing, etc.

It is already evident from the above to what degree Professor Znamenskii maintains correct methodological positions in establishing his "system of measures".

Let us proceed to the central point of the "system of measures", proposed by the author. "The proposed measures for controlling the beet webworm were confirmed by the Presidium of the Academy of Agricultural Sciences subsequent to the report of VIZRa of March 21, 1933", states the author and proceeds to list an"arsenal" of points from the decree of the Presidium of VASKHNIL, without telling one work about the history of measures for controlling the beet webworm, and without indicating the sources from which the system was basically derived.

It is known that the sugar industry has been interested in controlling this pest, one of the most dangerous pests of the sugar beet, for a long time. The Glavsakhar [Main Sugar Trust System] has built up an entire network of entomological institutions long ago, which represents one of the oldest and most powerful networks. Glavsakhar, possessing adequate qualified personnel for the control of this pest is equally well provided with means necessary for such control, i.e. equipment and poisons. Measures for controlling the beet webworm were developed primarily by the sugar industry, as most interested in destroying the parasite. Already in 1930 the system of Glavsakhar possessed a well established, orderly, though not quite complete system, established under a decree of Glavsakhar for the control of the beet webworm. This factor should not have been disregarded by the author, who should have stressed it instead; nor would it have impaired the significance of his article. How does the author present the system of measures he obtained from the sugar industry?

Let us proceed with the formulations of individual points of the system and our commentaries to them.

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Paragraph 3 of the Znamenski system is formulated as follows: "to establish regular observations on the development of eggs, at mass appearances of butterflies, and in places of large accumulations of fertile egg laying females to organize the catching of butterflies with the aid of gauze drag-nets" (p. 20, Zbornik) and further: "Catching butterflies should begin from the moment control establishes that eggs are reaching the maturing stage." (p. 21)

The formulation is altogether clear and precise. Instead of the immediate use of drag-nets in places where butterflies have made their appearance, it is advisable, according to the author, to establish a thick net of observers who will instead of controlling, spend their time watching butterflies move playfully from place to place, observe them mature and develop their eggs, and attend to their destruction only in places where butterflies with matured eggs concentrate.

The harmfulness of this procedure is clearly apparent even to an illiterate, collective farmer. The author forgot the principle he had referred to himself concerning the distribution of the beet webworm by winds, which occasionally results in the appearance of butterflies in places where they are least expected. He overlooks that the enormous distances covered by the pest in years of its mass development may not be taken care of by a large army of observers assigned to watch for the maturing of eggs. How will practical workers interpret this measure? Here the kulak is given free reign in that he will try, on the basis of scientific data provided by Znamenskii, to discard all control and be content to engage in observation only. What is the value of this statement of the author's and who would speak thus if not a class enemy.[1] If Prof. Znamenskii had taken the trouble to read the instructions provided by Glavsakhar, he would have found reference to the compulsory measure of catching butterflies of the beet webworm immediately following their mass appearance, irrespective of their sexual composition or the maturity of their eggs.

The author's statement results from his general underestimation of mechanical methods of control, and thisis equally reflected in a series of subsequent issues of VIZRa (Zbornik No. 8)[2], where it is claimed that "so long as we have waste lands, we shall be obliged to catch butterflies with drag-nets to protect our sugar beet." Thus the lower personnel is oriented concerning the catching of butterflies of beet webworm, primarily on waste-lands, while this should be done in the first place on sugar beet fields and plantings. It follows, moreover, that wherever waste lands are absent (of which, incidentally, there are few in the zone of sugar beet plantings) butterflies are not to be caught at all. The stress is not the mass of flown-in butterflies that lay eggs but on waste lands. It is further

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1. With respect to No. 13-9 of April 22 of this year, VNIS proposes to include into the instruction on the control of [Loxostege sticticalis L.], compiled by VIZRa, directions concerning the necessity of organizing a state and collective farms practical observations of the appearance and development of these pests. A norm may be accepted for the endangered regions, proposed by a compulsory directive of the Kiev Oblispolkom of April 9, 1934: One observer for every 30 hectares of sugar beet sowings."

In accusing others of damaging activities VNIS apparently commits them itself backed by the compulsory decree of Oblispolkom. One observer for every 30 hectares of sugar beet plantings will require an enormous army of observers, i.e. 50 thousand men throughout the Union for sugar beet alone.

2. The authors had possibly in mind not No. 8 of the "Zbornik" but the special issue submitted to members of the XVII Party Conference. Ed.

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necessary to make reference to the article written by Lindeman and Custri, published in the same issue (6th) of Zbornik of VIZRa, to which the author refers, in evaluating mechanical methods of controlling the beet webworm. According to the above authors, the efficacy of catching butterflies with the aid of drag-nets does not exceed 7 - 12o/o of the original presence of the pest, which does not correspond to data available at Glavsakhar. This data testifies to the fact that the efficacy in catching is about 40 o/o at a single passage with drag-nets. Regular catches of butterflies with drag-nets clearly demonstrate the significance of this method. Thus in 1932 alone, over 33 thousand kg. of butterflies were collected on 214 sugar beet farms in the old zone of sugar beet planting, in an area of close to 202.000 hectares of sugar beet fields.

Considering that there is a minimum of 25 thousand females per kg. of butterflies and in rating the egg production of one female at 100 eggs, caught butterflies would leave behind a progeny of 400 specimens per 1 square mile of cultivated area.

Let us turn to another measure recommended by the author.

Paragraph 5 states: "During the propagating of caterpillars on plantations, weeding is to be done only in rows, leaving actual weeds temporarily inbetween rows." Here the author refers to the article of Pivovarov, published in the same issue of Zbornik (worker of the Department of VIZRa at TSCHO). Let us follow the author to his original source. On page 32 of Zbornik, V. Pivovarov in his article on "Weeding sugar beet rows", writes in the first paragraph: "the weeding of noxious plants among sugar beets prior to the appearance of the caterpillars of the pest represents a method of controlling the worm, since the butterflies do not lay eggs on crops freed of weeds. But from the moment the first generation of caterpillars appears weeding should be discontinued since otherwise caterpillars will crawl over from the weeds on which they usually feed onto the weeded sugar beet rows and immediately destroy them. It is, moreover, known that if crops are left unweeded, caterpillars will remain on various plants. This circumstance compelled the discontinuance of weeding when caterpillars of beet webworms made their appearance, and this practice is prescribed in compulsory orders as methods to be used in controlling the pest."

Comrade Pivovarov admits further that this measure reacts harmfully upon the growth and yield of sugar beet plantings and recommends as a compromise the method proposed by Prof. Znamenskii. Where was the editor of the magazine when he published such a clearly detrimental article? Who had officially approved such a "system" we do not claim to know. But the fact speaks for itself. People are steadfastly proposing what had been rejected by the Party and the Government a long time ago as kulak methods directed to the derangement of the work of weeding (referring in addition to some "compulsory orders" for the discontinuance of weeding) which is in direct contrast to all instructions issued by the Party and the Government concerning this problem.

Let us dwell in greater detail on this "method". The weeding of sugar beet plantings should take place in such manner that by the time of the maturing of caterpillars it should be completed and weeds destroyed and removed simultaneously. If the weeding is delayed and is carried on during the maturing of caterpillars, it should proceed simultaneously with chemical control and the application of mechanical measures. In leaving weeds in between rows we not only do not preserve the sugar beet from caterpillars but on the contrary expose the plant crop to greater risks. We would, moreover, be directing practitioners not to use machines for weeding and would make the collecting of caterpillars by traps more difficult. From the economical point of view this leads to repeated weeding which, considering the shortage in labor, would result in plant losses or a considerable reduction in yields.

It is not permissable to transfer the experience gained on small plots under conditions of an experiment station into industrial production. This would delay the weeding of the sugar beet and in turn result in a lowering of its yield.

In paragraphs 7 and 8, where Prof. Znamenskii speaks of the application of mechanical measures in controlling caterpillars and combining them with chemical control, there is no precise formulation of the necessity for applying immediate spraying after the last passage of drag-nets, while, as indicated above, little mention is made of mechanical methods of control.

Nor does the author formulate precisely (in paragraph 12) the matter of first plowing and (in paragraph 15) the point concerning deep plowing in sugar beet planting. The latter point may be interpreted as if deep plowing is done only for the purpose of controlling the beet webworm and if this pest is absent, to be satisfied with shallow plowing in sugar beet fields. Deep plowing is introduced as a compulsory measure as a means to increase the yield of sugar beets, irrespective of the presence or absence of the worm, a circumstance the author should have stressed. The necessity for deep field plowing wherever caterpillars appear, should have been connected with the need for deep plowing of sugar beet crops as a measure for increasing its yield.

In analyzing thus the measures for controlling the beet webworm on sugar beets (we shall not dwell, incidentally, upon other crops in the zone of sugar beet fields and not mention measures for weed control, the cutting of grass along roads, etc.) but accepting as a basis the system of Glavsakhar and deliberatively distorting it, Prof. Znamenskii also provides other general statements relation to measures applied against the pest throughout the Union. Here, as in the case of basic remainders, he once more almost completely ignores the steppe regions closest to zones of sugar beet plantings which lack an analysis of its various branches; instead of definite measures for the respective conditions, directed towards reducing quantities of beet webworms, reference is made only to the procedure concerning "remainders" (remaining quantities of the pests) on the stubble of winter and summer crops and the "possibility of eliminating these by methods of techno-agricultural practices." As to measures of control used on other arable lands, such as flood lands (water meadows?), solonchak, gullies, and how the work of control is to proceed in connection with the reconstruction of industry in these sections, nothing is said about this.

Instead much attention is again devoted to zones of uncultivated part-desert lands and steppes. While not denying the necessity of eliminating the beet webworm in the latter focuses, adequate attention should have been given to regions closest to its distribution and definite directions provided concerning the establishment of control there; nor should the entire problem of controlling the pest have been reduced to the solution of two problems, i.e. the measures applied to sugar beet crops and rational sheep growing in distant oblasts where the beet webworm remains. Such "system" does not solve the problem of pest control. It is possible that lacking concrete data for the establishment of a uniform system intended to destroy the beet webworm in the USSR, VIZRa was unable to present it in a well developed manner, but it could at least have set the problem upon a level of principle, which represented its main task. Instead this point was not taken in the above articles that dealt with the control of the beet webworm, nor were methods for concrete research in this field indicated.

Taking the above into consideration we arrive at the following conclusions:

1. "the system of measures" of Znamenskii, in the form published in the Zbornik of VIZRa, is harmful and requires immediate revision.

2. In establishing a system of measures to control the beet webworm it is necessary to utilize the rich theoretical and practical data of the Sugar Industry, which provides the most correct measures in zones of sugar beet planting.

3. It is necessary to dispose of the problem of the beet webworm in steppe regions of the Ukraine, Donets oblast, Northern Caucasus, central and lower Volga, the closely adjoining areas of sugar beet plantings and to develop a concrete system for controlling the pest in these sections, giving consideration to local characteristics.

4. To place the problem of elimination the beet webworm and to point to methods for its fulfillment upon a proper level.

END OF ARTICLE

Original signed by A. Dereviancheko

Kiev, VNIS, Sector of ZARA

3 March 1934

14 May 1951

Tarasov, V. M.
The chemical method of control measures of agricultural pests and diseases in the III five year plan.
Vestn. Zashch. Rast. 1939(1):15-23
421 p942 1939

Translated from the Russian
by S. M. Monson

The plan published below on chemical control of pests of agricultural crops during the third five-year plan was discussed at conferences in which participated members of VIZRa, the Main Administrations Of NKZ of the USSR and the supervisory staff of the Planning Administration of NKZ. Some of the necessary chemicals, i.e. cyanide and carbon bisulfide, and several others were not included in the table. [Footnote on p. 15]

A radical reconstruction of agriculture of the USSR in the first two five-year plans, which covered the organization of collective and state farms, their organizational-economic stabilization, an increase in mechanization in agriculture, the training of special cadres for the control of agricultural pests and diseases, the output of insecto- fungicides and equipment of our own manufacture for the controlling of pests of agricultural crops, created favorable prerequisites not alone for a widely planned development of protective measures, but also ~~in~~ for eliminating focuses of many pests and diseases. The significance of measures intended to control pests and diseases of agricultural crops, in order to preserve yields, was repeatedly stressed in the decisions of the Party and the Government. In these decisions direct instructions were given to land and industrial organizations concerning proper measures for plant protection and for the supply of adequate means to effect control on the necessary scale.

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In the years of the first and second five-year plans numerous focuses of locusts, [Acridodea] and beet webworm, [Loxostege sticticalis] were liquidated as a result of intensified control of pests and diseases and an improvement in agricultural techniques. The area inhabitated by ground squirrels was drastically reduced, and the degree of infection of grain crops by smut diminished.

From year to year the volume of chemical control of pests and diseases affecting sugar beet, cotton, flax, hemp, grape vines and other crops increased considerably. The measures, nevertheless, did not liquidate pests and diseases having economic significance and losses remained considerable. The principal causes that interfered with the development and strengthening of pest and disease control from a technical and organizational point of view were:

1. Extreme shortage in equipment at MTS and state and collective farms essential in the control of agricultural pests and diseases. Because of this situation chemicals available in even adequate amounts were not used effectively or in time. There still prevail altogether inadmissible occurences when collective farmers, because of lack of equipment, are compelled to spread poisons with their bare hands, spray them with brooms or other ineffective means harmful to their health.

2. Inadequate provision of qualified personnel in the control of agricultural crops of krai, oblast, MTS, regional organizations and collective farms.

3. Inadequate supplies of the most important chemicals (copper sulfate, pulverized sulfur, calcium arsenate, barium chloride.)

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4. High cost of chemicals, as a result of which collective farms apply either ineffective, labor consuming mechanical methods of control, or do not apply any control at all which, naturally, leads to losses in yields.

5. Poor quality of work, the result of untimely applications of chemicals and agricultural techniques and the non-observance of technical rules of control.

6. Lack of statistical records on the distribution of pests and diseases prevents correct planning and operative guidance of the control of agricultural pests and diseases.

7. Inadequate evaluation and ignoring of measures in the control of agricultural pests, by land organizations ("zemorgan") and frequent reconstruction and disruption of organizational practices on locations which at times result in the loss of best qualified personnel specialists.

8. Lag behind the production demands at scientific-research institutions which, incidentally, have not as yet developed effective and inexpensive methods of controlling many dangerous pests and diseases "plodozhorka", [Laspeyresia], "cherepaskha", [Hemiptera]; click beetles (wireworms); loose smut, rust, etc.). Studies connected with the development of chemical methods of control are proceeding very slowly, in spite of the large interest they represent for agriculture. The study of chemicals such as "olovianek" and gas sulfur, carboneferous oils, the substitution for chemicals of which there is a critical shortage, the obtaining of new equipment, necessary in the control of pests of agricultural crops (caterpillar glue).

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9. Absence of scientific methods on current and future planning of measures in controlling pests and diseases in agriculture. Scientific long-term prognoses concerning the development of pests and diseases are not issued, nor is existing experience generalized, though both are essential for proper planning.

At the present state of science it is not possible to see ahead three or four years with respect to mass appearances of pests and diseases. Because of this the production of insecticides and fungicides planned for in the third five-year plan represents a reserve which may be "maneuvered" depending upon the degree of development of some pests and diseases. Instructions by the Party and Government concerning the liquidation of focuses of pests and the prevention of [illegible]riousness to agricultural crops form the basis for the development of a prospective plan of control of agricultural pests and diseases during the third five-year plan.

In that period a variety of methods will be applied: chemical, physical-mechanical and biological methods of agricultural techniques, all intended to stop the mass development of pests and diseases.

In the present article we are submitting our considerations on the subject and estimate the volume of ~~the~~ work with regard to the chemical method.only.

To determine the volume of work devoted to individual pests and diseases, their distribution, propagation, data covering many years was taken into consideration, as were available methods of control and sowing areas of affected crops. The plan refers to work plots dealing separately with each chemical. Actually, however, multiple practices will be applied, in cases of repeated infections, depending upon the degree of infection on crops, or combined practices directed simultaneously against pests and diseases.

"Saranoharye", [Acridodea] The plan to control herds [Calliptamus] of [Acridodea] calls for the liquidation of many focuses and the transfer in the last years of the five-year plan from the control of "kulizhye"(?) locusts to the completion of reduced focuses of [Calliptamus].

It is proposed to eliminate entirely focuses of non-herd locusts [Aeropus oedaleus] in many regions, to radically reduce infested areas and lower the intensity of infestation in all regions of distribution in order to provide complete protection to crops from pests.

The control of [Acridodea] is tentatively proposed for individual years (in thousands of hectares), as indicated in table:

Table I

"Saranchovye" [Acridodea]	1938	1939	1940	1941	1942
Total in hectares	2653.5	1989.0	1840.0	1630.0	1260.0
Including:					
[Calliptamus]	305.5	240.8	160.8	129.6	121.0
[Aeropus Oedaleus]	2348.0	1748.2	1679.2	1500.4	1139.0

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GROUND SQUIRRELS ("susliki")

The plan for controlling ground squirrels calls for consistent annual reduction of their mass settlement and an over-all reduction in infested areas. In 1942 it is tentatively planned to reduce the infested areas by 11.800 thousand hectares, as against 24,532.5 thousand hectares for 1938. In order to accomplish this, wide applications of chemicals and mechanical control are planned. It is further essential to simplify the order in which chlorine picrin is obtained and its application as a strongly active poison.

FIELD MICE

In recent years field mice have become widely distributed in many areas of the USSR. Mice cause damage in various degrees annually and all over. The volume of work connected with the control of field mice will remain almost stationary throughout the entire five-year period: 7715 thousand hectares for 1938; 9277 thousand hectares for 1939; 8220 thousand hectares for 1940; 7500 thousand hectares for 1941; 7000 thousand hectares for 1942.

BEET WEBWORM [LOXOSTEGE STICTICALIS L.]

In the third five-year plan a gradual reduction in chemical applications is anticipated because of the reduction in annual infestation by this pest, resulting from improved agricultural techniques and active control. In 1942 chemicals will be used on 300.000 hectares, as against 506.000 hectares treated in 1938 and 95.9 thousand hectares in 1937.

CUTWORM MOTH [AGROTIS SEGETUM SCHIFF]

In 1937 and 1938 areas of infestation grew in number. Control was exercised in an inadequate volume in those years and it is consequently proposed to treat in 1939 up to 725.000 hectares, as against 630.000 hectares in 1938; the last years of the five-year plan will remain stationary at 700.000 hectares.

COTTON PESTS

Because of the fact that during the second five-year plan and the first years of the third five-year plan it had not been possible to develop control of cotton pests because of a limited supply of chemicals, the plan calls for more complete chemical control in the remaining years of the third plan, and repeated treatments in areas affected by the red spider (?) [Tetranychus telarius - of authors]; "chlopkovaia sovka", [Chloridea obsoleta F.]; "karadrina", [Laphygma exigua Hb.], and aphids.

The control of pests of the cotton plant, according to years, is tentatively outlined (in thousands of hectares) in table 2.

Table 2

YEARS	TOTAL	INCLUDED IN THE CONTROL ARE:		
		(Red Spider) [Tetranychus telarius of authors]	[Chloridea obsoleta F.] and [Laphygma exigua Hb.	Aphids
1937 - Actually Treated....	699.2	360.4	210.1	91.5
1938 -	1260.7	278.4	616.3	189.0
1939 - Planned...........	1632.0	420.0	750.0	295.0
1940 - Planned...........	2000.0	550.0	900.0	360.0
1941 - Planned...........	2295.0	700.0	1000.0	390.0
1942 - Planned...........	2440.0	800.0	1005.0	420.0

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Table 3

YEARS	TOTAL	INCLUDED IN THE CONTROL ARE:		
		[Curculionidae] (weevils) and [Aphaniptera] (fleas)	Aphids and [Eurygaster]	Diseases
1937 - Actually Treated...	932.0	880.2	51.8	-
1938 - Actually Treated...	2149.0	1990.0	145.0	14.0
1939 - Proposed...........	3055.0	2905.0	135.7	15.0
1940 - Proposed...........	3875.0	3700.0	150.0	25.0
1941 - Proposed...........	3900.0	3700.0	150.0	50.0
1942 - Proposed...........	3200.0	3000.0	150.0	50.0

PESTS AND DISEASES OF THE SUGAR BEET

In planning control of sugar beet pests, the considerable loss in this crop caused by the sugar beet weevil was taken into consideration. In recent years, despite an increase in the volume of chemical control, the areas of distribution and density of infestation by this pest had increased considerably because of the poor quality of chemical and mechanical control and the presence of favorable conditions for the mass propagation of the pest. The plan proposes the application of repeated treatments by chemicals, depending upon the intensity of the infection, of the entire sugar beet area and the substitution of Paris green by the more effective chemicals, fluorine, salts and barium chloride.

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The proposed volume in ~~the~~ control (ling) of pests of the sugar beet is presented in Table 3.

PESTS AND DISEASES OF "LEN-DOLGUNETS" [LINUM INDEHISCENT (HEILR.) VAV. ET ELL.], HEMP, TOBACCO AND MAKHORKA, HOPS, BAST, AND OIL CROPS

The control of pests of [Linum indehiscent (Heilr.) Vav. et Ell.], hemp, tobacco and makhorka, hops, bast and oil crops has up to now been conducted on a very limited scale and not been appreciated sufficiently by "zemorgans", (land organizations). The five-year plan proposes to apply chemical methods to all severely infested areas.

The tentative scale of the work is outlined for the respective years in Table 4.

Table 4

YEARS	[Linum indehiscent] (Heilr.) Vav. et Ell. (flax-dolgunets)	Hemp	Tobacco and Makhorka	Hops	New Bast Crops	Oil Crops
1938	116.0	40.0	39.5	38.9	39.3	490.0
1939	135.6	56.0	55.1	32.8	44.9	433.7
1940	195.0	80.0	66.0	32.6	50.0	550.0
1941	225.0	100.0	66.0	32.6	54.0	646.0
1942	250.0	110.0	67.0	32.6	56.0	736.0

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PESTS OF LEGUMINOUS AND GRAIN CROPS

Up to the present time the control of these crops was exercised on an inadequate scale because of the limited supply of chemicals; the result was loss in yields. The plan tentatively proposes to apply chemical methods of control to all heavily infested plots during the last years of the five-year plan; (in thousands of hectares) see table 5.

Table 5

YEARS	Control of Pests of Leguminous Crops	Control of Pests of Grain Crops
1938...........................	180.0	60.0
1939...........................	226.4	175.6
1940...........................	310.0	270.0
1941...........................	380.0	300.0
1942...........................	435.0	326.0

PESTS OF RUBBER-BEARING PLANTS

In connection with the planned large expansion of areas planted with rubber-bearing plants and the enormous economic significance of the latter, the five-year plan proposes the following measures for the control of pests of these crops: to treat in 1938 9.7 thousand hectares; in 1939 - 15.9 thousand hectares; in 1940 - 31.6 thousand hectares; in 1941 - 73.3 thousand hectares, and in 1942 - 114.3 thousand hectares.

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PESTS OF ALFALFA

In establishing the volume of work for controlling these pests, the inadequate introduction of destructive measures performed in preceding years was taken into consideration, as were the increase in planted acreage and the wide distribution of the snout beetle(?) [Phytonomus variabilis Hrbst] or [P. transylvanicus Petri (?)] and other pests of this crop. The plan tentatively proposes the following measures, to treat: in 1938 - 172.0 thousand hectares; in 1939 - 205.9 thousand hectares; in 1940 - 280 thousand hectares; in 1941 - 365 thousand hectares; in 1942 450 thousand hectares.

PESTS AND DISEASES OF GARDEN CROPS, VINEYARDS AND BERRIES

Up to the present time inadequate attention was devoted to pest control affecting these crops. Chemicals supplied in limited quantities for the purpose remained frequently unused because of the unfamiliarity and underrating of the latter by land organizations ("zemorgan") and extremely limited mechanical means for the work of destruction; ~~of~~ this led to enormous annual losses and reflected detrimentally upon the quality of products. In the last years of the five-year plan it is proposed to apply wide complex chemical measures with repeated treatment to the entire infested area of orchards, vineyards and beery plots, and also to apply new, more effective chemicals (meritor, caterpillar glue, coppermeritol, mineral oil emulsions, beta-naphthol).

The volume of the work is tentatively outlined in table 6.

YEARS	PESTS AND DISEASES OF GARDENS AND ORCHARDS					PESTS AND DISEASES OF VINEYARDS		PESTS AND DISEASES OF BERRY CROPS
	FRUIT ORCHARDS							
		INCLUDING						
	TOTAL	PESTS	DISEASES	MOSSES AND LICHENS	NON-BEARING	TOTAL	INCLUDING DISEASES	
1938	1347.5	1039.5	244.7	63.3	821.0	452.5	404.0	39.4
1939	1231.4	926.1	252.5	72.8	622.0	517.5	490.0	38.3
1940	1710.0	1140.0	390.0	180.0	700.0	810.0	765.5	54.4
1941	2460.0	1604.0	621.0	235.0	800.0	975.0	921.7	69.9
1942	3000.0	1882.0	818.0	300.0	900.0	1140.0	1085.3	91.4

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PESTS AND DISEASES OF VEGETABLES AND POTATOES

In the third five-year plan a radical expansion of the control of pests and diseases of vegetables by chemical methods is contemplated, as well as the protection of seed potatoes from phytophthora; these measures are tentatively outlined in table 7 (in thousands of hectares).

Table 7

YEARS	PESTS AND DISEASES OF VEGETABLES			DIRECTED AGAINST PHYTOPHTHORA OF POTATOES
	TOTAL	INCLUDE		
		PESTS	DISEASES	
1938	593.6	569.7	23.9	100.0
1939	584.5	561.8	22.7	132.0
1940	710.0	654.2	55.8	162.0
1941	1000.0	913.1	86.9	190.0
1942	1200.0	1080.0	119.5	250.0

PESTS AND DISEASES OF SUBTROPICAL CROPS

The main task in the control of pests and diseases of subtropical crops during the third five-year plan is the prevention of losses of yields from pests and diseases by complete chemical control of all infested areas. In this connection the five-year plan contemplates the following volume of work: To treat in 1938 - 62.6 thousand hectares; in 1939 - 9517 thousand hectares; in 1940 - 118.3

thousand hectares; in 1941 - 136.1 thousand hectares, and in 1942 166.3 thousand hectares.

CONTROL OF SMUT OF GRAIN CROPS AND DISEASES OF TECHNICAL CROPS ON SEEDS

Despite the reduced infestation of wheats, oats, barley, millet and winter rye by smut, the plan proposes, for the purpose of liquidating smut altogether and in order to improve the seed industry, to treat annually 100 o/o of planted seeds by chemical and thermic methods.

It is also proposed to treat annually planted seeds of cotton, flax-dolgunets [Linum indehiscent (Neilr.) Vav. et Ell.], flax, var. [Linum brevimulticaulis Vav. et Ell.]; and southern hemp one hundred percent, and seed potatoes in the following amounts: in 1938 160.3 thousand hectares; in 1939 - 186.1 thousand hectares; in 1940 200 thousand hectares; in 1941 - 220 thousand hectares, and in 1942 240 thousand hectares.

STORAGE PESTS AND DISEASES OF VEGETABLES

In planning for the disinfestation of grain warehouses and the grain itself, it was determined to introduce compulsory sanitary rules, increase the number of new grain storing places and vegetable warehouses, improve general conditions for storing grain.

In order to prevent fires from explosive vapors of carbon bisulfide, when used in disinfestation of seeds of peas and grain crops, mixtures of carbonyl chloride (?) and carbon bisulfide, in the proportion of 4:1, are proposed. The volume of pest and disease control of vegetables in warehouses is tentatively outlined in table 8.

Table 8

Years	Disinfestation of Grain Warehouses		Disinfestation of Grain (thous. of tons)	Deratization (thous. sq. m.	Disinfestation of Vegetable Storage	
	Moist Method (thous. sq. m.	Gas Method (thous. cu. m.			Moist Method (thous. sq. m.	Gas Method (Thous. cu. m.
1938	110,495	11,995	4,099	81,950	9,575	10.976
1939	149,955	16,904	3,732	64,020	26,305	11,661
1940	155,110	21,500	4,010	66,045	29,630	13,600
1941	163,320	25,000	4,000	69,276	32,095	15,600
1942	170,130	28,590	4,000	72,425	34,660	17,700

Declassified and Approved For Release 2013/03/22 : CIA-RDP80R01426R009900020001-4

Tarasov, V. M.

PESTS OF SHELTER BELTS AND FORESTS OF LOCAL SIGNIFICANCE

Up to now, hardly any attention was given to the control of forest pests on the part of ("zemorgans") land organizations, specifically, by Glavles of NKZ of the USSR (Main Forest Administration). As a result, no work was produced although the destruction of shelter belts by pests and diseases took an annual high toll. In addition, forests adjoining gardens became focuses of infestation by agricultural pests. The third five-year plan proposes to assign the control over forest pests to forest organizations for areas of 60.7 thousand hectares in 1942, as against 25.6 thousand hectares in 1938. This will, of course, not provide complete protection for forest shelter belts from pests and diseases, but it is nevertheless, not feasible to increase the volume during the 5-yr plan, considering the lack of experience in this field and the high cost of the work.

(DEMAND FOR CHEMICALS IN THE CONTROL OF PESTS OF AGRICULTURAL CROPS)

In conformance with the contemplated volume of work during the third five-year plan, the need in chemicals has been determined according to established standards. The necessity to replace in the future ineffective chemicals, such as sodium arsenite, Paris green and kerosine with more effective chemicals, i.e. flourides, barium chloride and caustic soda, and the use of new chemicals, is anticipated in industrial experiments on a wide scale.

specific

A tentative estimate of the need in principal chemicals for ~~individuals~~ years of the five-year plan is outlined in the following figures (in tons) in Table 9.

Tarasov, V. M.

Allocated for work according to plan

Table 9

NAME	~~Issued for Work According to Plan~~ Allocated for work according to plan			Tentative Estimate of the requirement ~~Required~~ for the Work		
	1937	1938	1939	1940	1941	1942
Sodium arsenite	2,702	3,685	2,856	2,600	2,400	2,100
Calcium arsenite	1,037	1,386	1,340	1,100	870	720
Calcium arsenate	2,533	2,769	3,616	6,800	9,500	11,500
Sodium fluorite	2,274	2,032	3,476	6,200	6,900	7,100
Sodium fluoride	3,624	9,020	8,709	11,900	14,900	16,000
Barium chloride	11,249	10,472	8,762	13,700	16,300	16,500
Paris green	1,696	1,876	2,100	2,100	2,100	2,100
Anabasine sulfate	445	696	1,040	1,500	1,700	1,900
Copper sulfate	5,573	6,791	6,884	11,000	15,000	18,400
Pulverized sulfur	8,826	8,835	11,953	18,900	23,000	26,700
Formalin	2,919	3,894	5,530	6,200	6,700	6,500
NEW CHEMICALS						
Meritol	-	-	-	160	700	1,700
Copper meritol	-	-	-	180	850	1,900
Solbar	-	30	7	130	190	270
Piretrum	-	-	-	-	60	100
Granosan	-	-	-	600	1,100	1,700
Caterpillar glue	-	-	-	160	210	240

Among new chemicals Piretrum, used in mass quantities abroad, is included in the plan in small quantities because of the unknown estimate of the cost of its manufacture. The prevailing cost for an experimental amount of piretrum is $150 rubles per kilogram; even if this were to be reduced in half, it will not justify the outlay on profits derived from storing yields; to increase the consumption of piretrum under the circumstances is therefore inadvisable.

In cases where scientific organizations will propose new methods of control or more effective chemicals, the requirement of the latter will be correspondingly changed and some substitutions made.

In connection with the increase in the use of chemicals, their general cost according to industrial prices has also increased, as indicated by the following figures: Costs amounted in 1938 to 148.885.2 thousand rubles; in 1939 to 151.353.7 thousand rubles; in 1940 to 208.439.8 thousand rubles; in 1941 to 257.396.6 thousand rubles, and in 1942 to 294.272.7 thousand rubles.

In planning the manufacture of chemicals for the individual years of the third five-year plan and their distribution among consumers of the industry, it is essential to consider that the main portion of chemicals is used during the first quarter of the year. Incoming chemicals should therefore be delivered in time, i.e. in the first quarter of the year and some chemicals no later than by May 15 of any year.

The enormous tasks confronting Soviet chemical industry in supplying agriculture with means for controlling agricultural pests place upon it the obligation to organize not only a quantatively large production but also the production of chemicals of high quality. Up to now, the industry frequently delivered substandard chemicals, resulting in the inefficacy of introduced measures or even spoilage of crops.

No less important is the problem of tare. Industry should, during the third five-year plan, arrange for a proper delivery of chemicals. As an example of proper delivery of goods, we refer to the food industry where packing in small weights has been practiced for a long time and includes instructions concerning the preparation of food products. The sale of chemicals in packaged form has been practiced for a long time abroad. Our industry ships poisons in large weights of no less than 16 kg. These loads are opened at the warehouses of Agricultural Supply offices and the poisons are then transferred to state and collective farms in their own containers. The latter seldom meet even the most elementary requirements for poisons. Transportation of poisons in unsatisfactory containers and without corresponding necessary labeling leads, as shown in practice, to the improper application of chemicals and errors, generally poor results, spoilage of crops, cattle plagues and even poisoning of people.

Depending upon the particular chemical, containers should weigh from 0.3 to 5 and 12 to 24 kg, labeling be made compulsory on the containers, the name of the poison be marked, its designation, methods of preparing the solutions, the norms of their use indicated. The introduction of these measures will prevent fatal cases and radically increase the quality of the work, since the components of poisons at collective farms are frequently prepared by naked eye measure for lack of weights.

BASIC INDICATORS ON MECHANIZATION

The mechanization of pest and disease control represents at present only a limited field which interferes with the normal development of chemical work and the imporvement of its quality. The third five-year plan proposes a radical increase in the mechanization of all procedures of chemical work and the complete elimination of the breach between chemical supplies and equipment. The system of Narkomzem of the USSR which includes 243.000 collective farms 6466 MTS (   ) and over 1000 state farms, is equipped only with some 120.000 pieces of machinery of all types. Of these a large part (70-80 %) represent kit apparatus of low productivity, approximately one hectar per day. It is further necessary to emphasize that the available equipment is for the most part of old manufacture, has become obsolete and depreciated in value.

Considering that the chemical pest and disease control of agricultural crops during the third five year plan will be of exceptional significance for the protection of yields of technical and grain crops, as well as fruits and vegetables, it is necessary to extend the manufacture of equipment, machinery and spare parts during the third five-year plan, permitting it to meet the needs of agriculture. According to conducted estimates, various types of machinery and spare parts, worth 300 million rubles, are needed. In order to eliminate the breach between the supply of chemicals and available equipment, it is necessary to deliver during the years of the third five-year plan into collective, state farms and MTS motor-driven and hand apparatus in amounts no less than those indicated in Table 10, (in thousands of pieces).

Table 10

Name of Machine	Obtained during the years of second 5-yr plan	Necessary for yrs of third 5-yr plan	Increase, as compared with supply during second 5-yr plan
I. SPRAYERS			
Kits	43.0	600.0	14
Pomona	7.0	85.0	12
Horse-driven "Zara"	6.7	22.0	3
Horse-motor-driven "Pioneer"	1.1	4.0	4
Tractor	1.1	13.0	13
Battery (complete)	-	0.56	-
II. DUSTERS			
Kits	30.0	400.0	13
Horse-driven	1.3	12.2	10
Tractor	0.8	4.8	6
III. OTHER MACHINERY			
Mordant machinery AB-2 and D-1	2.7	27.4	10
Ideal	-	47.0	-
PUM-1	-	9.3	-
Auto dispersers	-	0.25	-
Hand mixers	-	4.50	-

This quantity of machinery will provide collective farms and MTS in individual agricultural zones during 1942 with amounts indicated in Table 11.

Table 11

ZONES	Collective AF Farms		At MTS	
	No. of collective farms (in thousand)	Average No. of kit apparatus outfits per collective farm	No. at MTS	Average No. horse driven and tractor mach. per MTS
Sugar Beet	60.0	4	1.2	23
Cotton	30.0	10	1.0	16
Flax - Hemp	84.0	2	0.9	3
Grain	56.0	2	3.6	3
Orchard - Vegetable	20.0	8	0.6	12
Total	250.0	4	7.3	8

The larger share of motor-driven and hand apparatus allotted to collective farms and MTS in the cotton, sugar beet and garden zones is explained by the fact that in these areas a large complex of chemical control directed against pests and diseases of various crops has to be accomplished during brief periods.

In solving the problem of mechanization in the control of pests during the third five-year plan, it is essential to devote particular attention to the creation of a powerful base for the production of horse, motor-driven and hand apparatus in regions where there is mass demand, specifically, at the plant "Communar" (Zaporozhie) and at the plant "Vulcan" (Leningrad, as well as at the Linets and Ostrogozh plants of NKZ. Simultaneously, it is necessary to reduce radically the cost of kits and particularly powerful equipment, since the prevailing prices for machinery are much too high.

Bogdanov-Kat'kov, N. N.
Cadres for plant protection from pests.
(Reference note). Zashch.Rast. (Plant Protection)
3:121-122. 1935 421 P942

Translated in full by
S. N. Monson

According to some data the number of entomologists in all countries equals approximately 7,000 people. The largest number is in the USA, next follows the USSR. In Western Europe, Germany and England follow in that order.

Our country, prior to the revolution, had only few entomologists. In 1894, there were 164 registered entomologists, the greater part of whom was engaged in problems of theoretical entomology, primarily systematics and only 37 of these worked in the field of applied entomology.

Ten years later, in 1904, according to official data, 208 entomologists were registered; the majority of these worked in the field of systematics, and on other problems of general entomology and only 42 were engaged specifically in pest control. Thus ten years later the number of applied entomologists had increased by only five.

In 1914 of the total number of 344 entomologists, 96 worked in the field of appleed entomology, while the rest concentrated on general problems of the subject.

In 1924 the total number of entomologists fell off; many "amateurs" gave up the study of entomology, those officially listed as entomologists withdrew, and the total number was thus reduced to about 300 men, of whom the majority turned to applied entomology, i.e., 160 men, and 138 remained in the ranks of those who continued work on systematics and the study of other problems in general entomology.

Bogdanov-Kat'kov, N. N.

These statistics are, it is true, not complete; in 1934 there were over 600 applied entomologists registered among the total group of 1211 people, specialists on plant protection; this figure included, in addition to entomologists, 337 phyto-pathologists, 105 agronomists, specializing in plant protection, 58 applied zoologists, 34 specialists on mechanization in plant protection work, 24 micro-biologists, 13 economists in the field of plant protection, etc.

The main group of 450 people consisted of workers in the age group of 30 to 40 years; 224 men were between 20 and 30 years old; 164 men 40-50 years of age, and 42 men were over 50 years old.

One hundred forty-four men had been engaged in the work for over 15 years; 284 men from 8 to 15 years; 272 men from 4 to 7 years; 132 men from one to 3 years, and 22 men up to one year.

The saturation of regions of our republic with specialists on plant protection is most irregular.

Leningrad oblast .... 328 men	Lower Volga 48
Ukrainian SSR 138	Gorki Krai 18
Moscow oblast 127	BSSR(White Russian S R).........15
Trans-Caucasia 124	Ivanov Industrial oblast........15
Central Asia 66	Tartar Republic.................13
Northern Caucasus............... 56	Dagestan........................10
TSCHO (Central Black Sea oblast)..55	DVK (Far Eastern Krai)..........10
Crimea 50	Western oblast..................10
Central Volga...................48	Northern oblast................. 8
Azov-Black Sea Krai.............45	Ural oblast..................... 7
Siberia 43	

Of the indicated number of 1211 people, 909 were non-Party members; 81 were members of BLKSM( ), and 49 were members and candidated of VKP(b). (All-Union Communist Party)

The training of cadres prior to the revolution was of an accidental nature; specialists were trained informally, individually, primarily at Universities (Moscow, Leningrad, the Shaniavskii University) and in different agricultural VUZ( ) (Petrovsk Agricultural Academy and the Kamenno-Ostrov Agricultural Institute).

In 1922 the training of cadres on pest control acquired a more systematic character, in connection with the establishment at Leningrad of the Institute of Applied Zoology and Phyto-Pathology

In 1925 the first class graduating from the Institute consisted of 40 people; in 1927 there were 51 graduates; in 1932 - 26; in 1934 there were 50; in 1935 - 115 graduates.

Along with the Leningrad Institute of Applied Zoology and Phyto-Pathology (now called the faculty of Plant Protection of LCKHI) (Leningrad Agricultural Institute), specialists on plant protection were trained at two VUZ (Higher Educational Schools), the Vladimir and the Ulianovsk UCHKOMBOV ( ), which at present have joined the Saratov Agricultural Institute as a separate faculty.

Considering the enormous tasks confronting the work of plant protection in USSR, in connection with the increase of yields, contemporary cadres do not meet the normal demands of the work of plant protection and call for a radical review of the problem of cadres as a whole.

In addition to training cadres, aspirants are being prepared in many VUZ ( ) and scientific-research institutions; to date there are 15 in training at the Leningrad Agricultural Institute, faculty of Plant Protection; at other VUZ there are 14 people; at VIZRa 17 people.

End of article.

5/1/ 51

Khokhriakov, M.
Thirty years of the scientific work of the great phytopathologist of the USSR (N.A. Naumov). Vest. Zashch. Rast. 1940 (5):146-147. 1940. 421 P942

Translated from the Russian by
Rosa G. Dembo

In November 1940 was completed 30 years of the scientific pedagogical and social activity of one of the founders of Soviet phytopathology - Doctor of agricultural science, Professor Nikolai Aleksandrovich Naumov.

N. A. Naumov was born in 1888 in Leningrad. After having graduated from scientific-technical high school in 1906 he enrolled in the physico-mathematical department of the University of Petersburg. Still as a student, working under the supervision of Prof. Kh. Ia. Gobi in the cryptogamic laboratory on morphology and on systematic of spore plants, N. A, Naumov chose the study of fungi as his major subject. In 1910 he successfully defended his dissertation on the subject: "On the problem of generation of zigospores in "mukorovykh," mucoraceae fungi which became his first published work (published in "Botanical notes of the University").

In 1910 N. A. Naumov started to work in the Office of Mycology and Phytopathology of the Science Committee of the Department of Agriculture first under the guidance of Prof. A. A. Iachevskii, then independently as a specialist, and after 1917 - as a scientist-specialist of GIOA, (ГИОА), State Institute Division of Agronomy, where after reorganization the said office was included. From 1919 until 1931 he was head of the phytopathological station of LSKhI (ЛСХИ) of Leningrad Agricultural Institute which was organized by his initiative. In 1930 N. A. Naumov was appointed supervisor of the division of phytopathology of all Union Institute of Plant Protection.

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During all this time N. A. Naumov studied the microflora of various raions of USSR, as a result of which he published floristic notes of fungi for Leningrad, Kursk, Tula oblasts, of Ural, Maritime krais, of Crimea and Central Asia. In the process of these investigations about 160 new species were described by him, of them 20 belong to the species described by him recently. Along with that N. A. Naumov accomplished special mycological research on mucoraceae fungi and published "Tables for the determination of Mucoraceae".

Of no lesser value are Naumov's achievements during the indicated period in the domain of phytopathology. It is sufficient to mention that the objects of his research were: Fusarium, which causes "drunken grain," fungi disease of cabbage, many fungicides, nonparasitic diseases, teratalogy, general plant pathology, methods of damage appraisal, locust diseases, plant immunity, the methodology for phytopathological research, in particular methods of cultures of parasite and saprophyte fungi, methods of infection, methods of precise microscopic technique, microphotography, rust of grains, etc.

N. A. Naumov began his pedagogical activity in 1911 when he delivered a series of lectures on plant diseases under the auspices of the Office of Mycology and Phytopathology. In September of 1916, N. A. Naumov was appointed professor of phytopathology at Stebutov Agricultural College for Women, which was later incorporated into LSKhI (ЛСХИ) (Leningrad Agricultural Institute). From 1918 he was professor of phytopathology at the Petrograd Agronomical Institute which was later incorporated into the Leningrad Agricultural Institute. For the period from 1922 until 1928 he delivered a series of lectures on phytopathology at the College of Applied Zoology and Phytopathology in Leningrad. In 1923 Naumov was appointed professor at the Leningrad State University.

Naumov is still engaged in his pedagogical work at the present time, being professor of phytopathology of the Department of Plant Protection at Leningrad Agricultural Institute, Professor of the Cathedre of Morphology and Systematics of Plants at Leningrad State University.

Naumov at the same time supervises the graduate work of candidates at Leningrad Agricultural Institute and at Leningrad State University, and formerly he supervised the graduate work of many aspirants at the All-Union Institute of Plant Protection, where at the present time he is the supervisor of the A. A. Iachevskii laboratory on the systematics of fungi.

Many of Naumov's students now work independently in various corners of the Soviet Union, often as supervisors of Departments of Plant Protection of Experiment stations, and also as instructors and professors of agricultural universities.

During the period of his scientific work, N. A. Naumov had two scientific missions abroad for the study of methods of control of plant diseases. Besides, he had a series of responsible missions in the USSR]. In particular, Naumov accomplished in 1938 unusually successful work during the specialist expedition of the People's Commissariat of Agriculture of USSR on the study of a pest for a new, previously unknown horse disease.

Naumov is the author of over 60 scientific works and 13 textbooks and of monographs, many of which are widely known not only in USSR, but abroad as well. It is sufficient to mention that in France there were several editions of his last monograph on Mucoraceae, in the systematics of which he is generally recognized authority. In 1939 Naumov was elected by the people's Botanical Congress vice-president of the Mycological Section.

All agricultural specialists use his textbooks (in Russian and in Ukrainian) in the study of phytopathology. Of great value for scientific workers are his two books on methods of mycological and phytopathological investigations. In 1939 he published a monographic summary on the rust of grain crops.

N. A. Naumov is the editor of many important works on mycology and phytopathology, which are published by specialists in Russian and in the languages of related republics as well. Nikolai Alexandrovitch edited important works left after the death of the founder of Soviet Phytopathology, Prof. A. A. Iachevskii "Foundations of Mycology" and "Bacterioses of plants." He is also the member of the editorial staff of the (НКЗемд.) People's Commissariat of Agriculture of USSR and of the magazine "Phytopathologische Zeitschrift" (Phytopathological Magazine).

Along with this Naumov is the advisor on problems of phytopathology for a series of practical institutions, connected with Agriculture or with the refinery of agricultural raw materials.

The characterization of Naumov would be incomplete if we do not mention his social work. From 1920 until 1932 he fulfilled the responsibilities of the secretary of the section of mycology and of phytopathology of the State Botanical Society. At the present time he is the vice-president (assistant president) of the office of that section, a member of the State Botanical Society of USSR, member of the Société Mycologique de France, Vereinigung der Angewandten Botanik (Society of Applied Botany), Société Linnéene de Lyon, member of the Scientific Soviet of the All-Union of Institute of Plant Protection and Leningrad Institute.

Since 1939 Naumov has been deputy of Maritime Raisoviet of the 127th electoral district of Leningrad.

As a person - Naumov is very modest, objective, tactful, and responsive, especially in those cases when persons seriously interested in their work address him.

All this taken as a whole made Naumov the most outstanding phytopathologist in the USSR. Therefore, he enjoys wide popularity and authority. Specialists of agriculture from various far places of USSR often address him for advice and for consultation on various problems of mycology and phytopathology.

The phytopathological societies of USSR note with great gratification the anniversary of the 30 years of Naumov's scientific-pedagogical and social activity and wish him further fruitful work for the benefit of our motherland.

May 3, 1951

Trans. 124
By:
B. Ruwell
Trans in part

N. A. Naumov

Leningrad. Institut zashchity rastenii.
Sbornik trudov.

Moscow. Vyp. 1, 1948

P: 51-59

(A disease of Winter rye, produced by a New strain of peronospore fungus <u>Sclerospora Secalina</u>, B. Naum).

General Signs of Infection and Symptoms of the Disease

The disease embraces only the plant's vegetative organs and characterized by symptoms which although they are very noticeable, often, do not attract attention. Unlike normal plants, the infected ones have large, brownish, not sharply outlined, unbordered spots on their leaf blades. Inside those spots the tissues die out progressively. After part of the tissues or all the leaf has died out the symptoms of infection seem to disappear and are finally confined to the presence of prematurely dead and brown leaves.

The disease can only be detected early in spring and until Winter rye's heading stage. It was first recorded on May 27th, 1942. There was a prolonged spring that year with returns of cold weather. We must think that the first symptoms of the disease can be detected somewhat earlier, especially as the infection process, judging from the still incomplete data on the agent's biology, takes place very early; it possibly starts in autumn, but more probably when the plant just starts rousing from its winter dormancy. A superficial examination can confuse the withering of rye leaves from the disease described with withering due to Septorias, Helminthosporia, in part to some Fusiaria, etc. This makes it necessary to give a more detailed description of the disease including the develop ment and also establishing the diagnostic symptoms.

The start of the disease is observed on single plants; only seldom can two or three infected plants be found next to one another in a row. The

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By:
E. Emwell
p: 51-59

winter rye fields where the observations were made were, humid and the spring held abundant precipitations. As it has been already noted the presence of spots is a characteristic symptom of infection. They are not well delineated, their limits are diffuse, their edges progressively and unnoticeably blend with untouched tissue. The distribution of spots over the leaf can vary. The spots can occupy all the width of the leaf. The tip in that case remains healthy; a narrow line along one or both sides of the leaf gets infected. Cases when all the leaf blade was infected were not scarce.

In some cases two spots set on the same leaf, one near the top or encompassing all of it, the other somewhat lower, or in the middle of the leaf's length.

As long as the leaf preserves its intensively green color (because of the cold weather and abundant moisture, all the winter rye plants in the field had a pale and yellowish green color in May), the limits of the infected parts (spots) get more noticeable because the infected part starts distinguishing itself from the healthy one by a yellow halo. A few days later the halo disappears but the infected part, takes on a brown color and becomes very noticeable. In some cases, the development of spots is accompanied by the appearance of a violet coloring. This symptom depends on the formation of anthocyanin in the infected part and is not a characteristic of the fungus; it indicates a reaction of the plant infected by the fungus. Rye, as is well known reacts by forming anthrocyanin to many external irritations.

One of the most uniform and valuable diagnostic characteristics of the disease is the fact that the surface of the leaf's infected part becomes covered with a minute eruption. This is noticeable to the naked eye and particularly well with a magnifying glass. The eruption then is perceived as minute dots. This is due to the fact that the fungus oospores, darker than the leaf tissue, show through it, but mainly this happens because the cospores themselves raise the plant's tissues that lie over them and form a protuberance. At a quick glance such dots can remind one of an infection by some minute strain of fungus from the genus Septoria or any other pycnidial fungus with tiny pyonidia.

In very few cases the fungus can also infect the leaf sheaf but it generally does not expand far down.

Towards autumn (by the end of August) the rye's lower leaves appear completely dead their blades, as a consequence of progressive loss of chlorophyl loses its color. At that time the portions of the leaf containing cospores of the fungus are distinguished by their yellowish brown color. The leaves of test plants transplanted into plots in spring, and infested with sclerosporia remained on the stems, but, in the field they all fell off by rye harvest time (August 15 to 18).

No matter how long the spot has been present on the leaf, it never gets shredded or cracked, as for the cospores, the infected tissues never release them as dust, which is so characteristic in other cases of grass infestion by fungi of the genus Sclerosporia (S. Graminoola, S. Kriegeriana and others).

Some cases of simultaneous infection of a rye leaf by the fungus studied and by strains of genus Septoria have been noted; in that case the symptoms add up and together with large pycnidial spots of Septoria laid out in loose rows, minute cospore dots much more numerous and scattered evenly on the leaf can be observed also.

In combination of the symptoms of the disease we have enumerated, allows one to recognize it easily and to distinguish it from some other diseases of leaves. This disease differs from that caused by fungi from genus Septoria by dark cospore dots distributed more evenly and in thicker spots, showing and partly protruding through the surface of the leaf; a difference in color can also be observed with a magnifying glass. Septoria pycnidia are paler, more diversified in size and are characterized by the presence of an ostiole noticeable with the enlargement afforded by a magnifying glass.

The disease studied differs from diseases caused by Helminthosporium when at the beginning the spots resemble Scleropora infection, by the presence of numerous oospore dots, whereas in rye Helminthosporium the spots appear as brown or yellow or even faded portions of the leaf, without any special structure. One could discern something common between this disease and the effects of the development on the leaf of saprophytic or semi-saprophytic fungi from Genera Cladosporium and Hormodendron and others closely related; but in those last cases the minute dots, noticeable to the naked eye and very distinct with a magnifying glass, present themselves as plain superficial tufts of sporophores of the fungi we named. This is different from the intramatically disposed oospores of the parasite described.

Circumstances accompanying the appearance and development of the disease.

As it has already been indicated the winter rye disease that is being described was first found on May 27th, when winter crops had noticeably started to grow. Spring which started fairly early and harmoniously (around April 15th to 20th) was later characterized by several cold periods and had abundant precipitation. It was not rare for it to rain all day long, and sometimes for several days in a row.

The disease started and proceeded that way in conditions of high atmospheric and soil moisture. In some fields, in lower locations water would stand on for a long while, soaked spots were formed where the plants perished completely or would stop in their development for a long time. The high moisture of the soil made frequent observations of the crops state, difficult. As a matter of fact it should be noted that no relation was observed between the appearance of the disease and the soaking of the fields: the infection of the crops is not a result of a weakened condition of the plants and the infected plants were discovered exactly in the places that has not been submitted to soaking.

The soil of the winter rye field where the disease was first found was a heavy subaryillaceous soil. Here is this field's history: In 1941 it was in fallow, in 1940 it was cropped in barley, in 1939 also partly in barley, and in 1938 in potatoes. In any case, there had been no rye in that field for a long time. In the Arkhangelok oblast experiment station for field cultivation the disease was recorded, both in commercial as well as in experimental fields. Apparently the disease develops independently from the place of the field in crop-rotation or from the predecessors. In all probability, rye gets infected in all cases when material for infection is at hand. Oospores preserved in the soil and over wintering there constitute this material. The oospores are disseminated with the dead and dried leaves with the products of their normal winter maceration and they also are freed from the rotted tissues of the leaf. So they can be carried by winds, to some extent by machines and tools to great distances.

Morphology of the fungus and its systematic position

The fungus that causes the disease is known in the form of mycelium and in the form of oospore. Its conidial stage has not been found yet. In this we can see a great analogy with a number of strains of genus Sclerospora for which the oospore stage is the only one (S. Northei West, S. Noblei, West).

The whole genus is characterized by the limited importance of the conidial stage in its developmental cycle and the predominate part is played by oospores. Only a few tropical strains living as parasites on sugar cane and some other southern grasses are endowed with conidial stage alone (S.

spontana West, W. Philippinensis West, S. Maydis (Racib.) Butler, S. Sacchari Myiake) --

Moreover it is known that when plants are infected by common circum-polar strains (S. graminicola) the oospores also play a more active part in comparison with conidia; so in Van Halton and Bliss's (Phyt, 1927) experiments when maise was infected with oospores there were 91°/o successful cases, against 11 percent when it was infected with conidia. It certainly is possible that under conditions different from those that prevailed where the observations were made (in Kotlass raion of Arkhangelsk oblast in Spring 1942) the fungus does develop a conidial stage.

In the form of sterile mycelium (that is before formation of oospores) the fungus has not been found either. The mycelium is very abundantly developed in the leaf by the time the oögonia and antheridia start. Its hyphae are very much branched, of considerable diameter although the caliber of single portions of the hyphae and their branches vary a lot even within small sections of mycelium. Their diameter varies between 10 and 20 mu. Very sharp transitions from finer to thicker sections and vice versa are noted. As the hyphae are already easily detected when they are alive unfixed and unstained they become most apparent after they have been stained in an acid solution with cotton blue with slight boiling; they assume a deep, bluer color as compared with the pale colored cells of the host tissue. To obtain clear results, it is recommended to use a "regressive" method of staining.

The oögonia are very easily seen in the tissues of the leaf after they have been boiled or after the air has been removed by a long stay in water. Even when little portions of the leaf blade are studied not in slices, but in transmitted light that filters through them the oögonia stand out because of their shiny appearance due to their abundant oil content. The oospores at all the stages of their development are characterized by their bright yellow or gold

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brown color, within one field of vision some darker oospores and some lighter colored ones can be observed. In time the color of oospores darkens but one does not observe a uniform color even in completely matured material.

The oospore wall grows firmly fast to the oögonium wall as in all representatives of this genus. The antheridia, round, elliptical or pear-shaped are found in quantities not greater than one for each oögonium.

Principal sizes: antheridia: 14.7 x 18 m or 16 to 18 m diameter; oögonia 33 to 38 m diameter, oospores 31 to 46 m (mature).

The oospores position in the tissues of the leaf deserves some attention.

When the leaf is studied by transmitted light, especially if the material is held against a light source or even has been boiled, one can see what an abundance of oospores is present in the tissues.

They deposit themselves there in huge quantities and fill an important part of the tissue's volume. They lie so close that many touch one another. It happens that in some places there are more of them, in some less, but in any case it is correct to say that they distribute themselves evenly, rather than in groups.

A transverse section of the leaf also shows that the oospores lie at different depths independently from the anatomical peculiarities of the leaf tissues. They can be found at any point of the mesophyll as well, immediately under the epidermal cells of both surfaces of the leaf, as in the immediate neighborhood of the fibro-vascular bundles, but they are never observed in the later. A longitudinal section of the leaf presents the same picture. For some reason, possibly because longitudinal sections are often thinner than transversal ones, it is easier to observe the respective positions of antheridia and oögonia on longitudinal sections.

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The characteristics of the fungus that we have enumerated indicate they belong to genus Sclerospora. The question of the fungus' position inside the genus that is to say, is this particular species new to science, or can it be identified with one of the already known earlier described species, is considerably more difficult,(because literature and all the more, herbaria are lacking at the place where the work is conducted).

Alà the species of genus Sclerospora are parasites of grasses. Among the circumpolar strains the following are known to us: S. graminicola the most wide-spread and long known strain of that genus, which infects two varieties of foxtail grass: Setaria irrides and S. Glanca in Europe, Asia and the U.S.A. In the U.S.A. it is also found on maize. Further comes S. Macrospbra that infects wheat in Italy and causes a "curling" of ears accompanied by a change of color and by the fact that they acquire an unusual pulpy consistency. This strain can infect maize (tassels turn green) and is found on a large number of other grasses. Then we know the specie S. Kriegeriana on Phalaris arundinacea. S. graminicola is also found along the tropics (In India on Pennisetuin spicatum.)

Many among the tropical species are known to us [S. Maydis (R a c i b.) Butler, S. spontanea West., S. Butleri West., (Ha Eragrostis), S. philipinensis West., S. Sacchari West., S. Javanica (R a c i b.) Palm.], but it is quite evident that our specie should not be compared to them.

To solve the problem of, to what specie our fungus should be related, it is necessary to bring information on its specialization and on that of all those with which it supposedly can be compared. Smacrospora is remarkable for its least clearly defined (most extensive) specialization: it infects maize, wheat, Phragmites communis, barley, oats, quackgrass (Agro-pyrum repens), rye grass (Lolium temulentum, C. perenne) foxtail grass (Alopecurus) fescue grass

(Festuca elatior), Chaetolohloa magna, Glyceria festuformis, and others.

Part of the hosts mentioned here, were infected only in experimental but not in natural conditions. Nowhere does rye appear as a host to S. Macrospora. All the remaining species of genus Sclerspora are characterized by a considerably narrower specialization. So, S. graminicola is noted on both varieties of Setaria and on Pennisetum spicatum also on millet (Panicum miliaceum) on Setaria italica, Euchlaena mexicana, S. philippinenses is noted on maize, Miscanthus japonicus, and Saccharum spontaneum, all the other have one or two hosts. Rye is not mentioned once amont them.

On the other hand we can quite definitely speak of the narrow specialization of the specie studied. We found it on rye exclusively and was not once recorded on wheat, oats, barley studied under the microscope. Neither did we find on different wild grasses growing with ryes in the same ecological conditions and even to some extent infesting rye (Alopecurus geniculatus, Agropyrum repens, varieties of Agrostis, Festico and others). It is true that we did not try to infect all these cultivated and wild grasses, because of the complete impossibility of causing oospores to develop vegetatively, but in any case we consider it a most essential fact that the fungus is found on rye only and is completely absent on other grasses. On the basis of this we say with certainty that it is adapted to rye exclusively.

When we take into account that not one specie of genus Sclerospora is described upon rye, in the literature, we get convinced that the specie we are studying is really narrowly specialized in relation to rye. If we bring the biological criterium, the help of morphological criteria, we will be easily convinced that in that case also there can be no supposition as to the identity of the specie studied with any one of those previously known. In any case the hypothesis that the fungus we found on rye is either S. graminicola, or S. macrospora, or finally S. Kriegeriana is set aside

Moreover this species of the fungus never causes a shredding of the tissue so typical of most of the other species and its oospores are never let loose except after a further natural destruction of the host's tissues during autumn, winter or spring months.

So, or data on the absence of coincidence of morphological characters, on the specialization of the fungus, and also the presence of a quite different type of infection, gave us grounds to say that this particular species is new to science, has never yet been described in literature.

Pathological and anatomical changes in the tissues of the infected plant

The mycelium of fungus runs through the tissues of the leaf only within the apparent limits of infection. It is possible that at very early stages of the disease's development, while there still are no spots, the mycelium can be found also in an apparently healthy green tissue. This, as many other facts, requires checking and additional observations: we did not study the very first phases of the fungus development inasmuch as the disease was not known previously and it had to be traced in later stages, when the symptoms were fully noticeable.

The changes caused by the fungus, come down to the development of intercellular mycelium and formation (also in intra-cellular spaces) of oösonia and antheridia. The tissues that contain the greatest quantity of cells turn brown although the chlorophyll in them does not get destroyed, it undergoes sharp changes and loses its ability tophoto-synthesis.

One does not observe any rough destruction of the leaf's anatomical structure, even less any destruction of any elements of the fundamental vascular or mechanical tissue. This apparently points to the fact that a completely formed leaf is attached by the fungus. The mycelium even during its further development doesn't cause maceration of the tissue, which is so characteristic of cases of parasitism by other species of genus Sclerospora and results in longitudinal splitting of the leaf lobe and of its sheaf.

Course of the disease's development

Our observations in 1942, allow to conclude that the disease proceeds progressively and is the result of the development of one and then of a single generation of the fungi during the whole year.

Rye gets infected very early, when a few leaves are present, soon after the snow has melted andthe first warm days with temperature of 0° over 24 hours or slightly above has started.

Notwithstanding uninterrupted observations of mature oospores during almost 8 months (May to December) we did not witness the growth of any oospores. Apparently the only growth after a winter period of dormancy, judging by its anology with other peronospore fungi, and in particular with representatives of genus Sclerospora, we can assume that as a result of their growth either a mycelium shoot or a conidiaphore or spontaneous zoo-spores are formed. In this case it would be more correct to suppose that when the oospores are sprouting zoospores precisely are formed; this idea is suggested by the ecological conditions of the inducer's development. When the plant gets infected and consequently when the oospores germinate the presence of moisture sufficiently liquid to form water, is predominantly important.

After the introduction of zoospores a mycelium develops which apparently diffuses fairly fast in the tissues and encompasses the area of a spot. After that and almost simultaneously in all the parts of the spot, the earliest ones, middles ones, the latest ones, the peripheral ones anthedria and oögonia start forming. The spot does not spread with time, only, in independent cases, is a slight increase of its original size, observed. The brown infected tissue dies out and that way prevents the parasite from manifesting its activity. By then the already formed and fertilized oospores attain maturity.

The oospores proceed toward their maturity during the course of the whole summer; a period of winter dormancy is apparently necessary for them. Prolonged and uninterrupted observation of the oospores have shown that by the end of August some essential changes take place in them, the color of the wall layers gets paler and yellower and the walls themselves softer. A slight pressure makes it burst and then most often on one side. The oospore contained are the ones that undergoes the most change. It becomes more homogenous and at the same time minutely grained, which can be noticed through the undamaged wall of the oospore. When the walls are broken their contents come out, mix easily with water and the minute grains acquire brownian movement.

Thus the inducer of the winter rye disease we have been studying has no conidial stage, its oospores do not germinate soon after their formation, repeated infections have not been observed. The course of the disease terminates soon after the completion of the parasite's developmental cycle. The fungus itself is characterized by the absence of the summer section of the development cycle, and in that it offers a resemblance with strains of the sub-genus Pycnochytium from genus <u>Synchytrium</u>.

In 1942 observations showed that the disease does not propagate from some leaves unto others, even at the same level. Each leaf is infected independently through the soil but not by the plant infected earlier. This does not in any way contradict the fact that once in a while, a later infection can be observed on the stem leaves. This explanation is that the infection has been brought to them by later growing oospores.

<u>Destructiveness of the disease</u>

A characteristic feature that determines the destructiveness of the disease is the fact that the fungus infects the plant at a very early age and also that its parasitism is accompanied by the interruption of the function of the chlorophyll producing apparatus. A plant can withstand infection of one or two leaves at that age with more difficulty than infection of even half of the leaves at a later date (by rust for instance). The disease cause the assimilative process of infected leaves to stop at stages of the plant's development when it must intensively speedily accumulate the products of assimilation to build up new leaves and stems and to strengthen the basal nodes. So, weakening of the young plants is the first result of infection.

Reduction of the existence of individual leaves can certainly be compensated by the work of the remaining ones, but this is possible only in a case when only a small part of them has been infected. In 1942 we observed infection on two (very seldom three) leaves per plant. It is possible that in conditions more favorable for the development of the disease the number of infected leaves will be greater, which will cause a diminution in the quantity of productive stems. Further observations will tell how often this happens in practice. In any case, the part of the disease among factors having an unfavorable action on winter rye shoots is undisputable.

For its destructiveness this disease must be set into the same category as Fusiarosis, Helminthosporium, Septorioses and even as development of rust (Pglumarum, P. triticina and P. graminis) on winter cereals. No immediate action of the disease on the plant's reproductive organs is observed, yet it is quite obvious that it has an indirect effect on the plant as a whole.

<u>Measures for controlling the disease</u>

and

The disease of rye we have described spreads through the soil cannot spread through any other way (except possibly through atmospheric currents and that to a limited extent) is not very dynamic in its expansion.

So, the main measures come down to choosing the necessary crop rotation system; it would exclude rye for a certain length of time, not yet determined by observations (in any case not less than two and not more than five to six years) and to not allowing to locate rye fields on adjacent plots for two or three years. The necessity for other measures disappears of its own, due to the very narrow specialization of the parasite adapted to rye alone.

Leningrad. Institut Zashchity Rastenii.
Sbornik trudov. vyp. 1-
Moskva, 1948. 426.9 L542S

Translated from the Russian by
Rosa G. Dembo

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Spravochnik po vaprosam karantina rastenii. no. 3
July 1941 464.478 Sp7

Translated in part from the Russian by
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